UNIVERSITY OF ARIZONA
39001003054429

Digitized by the Internet Archive
in 2025

https://archive.org/details/musicinstruments0000unse_y9g4

MUSICAL INSTRUMENTS

OUTLINE OF THE COURSE

THE FUNDAMENTALS OF MUSIC

First Year BY PROF. KARL W. GEHRKENS

1. The Notation of Music
2. The Function of Rhythm in Music
3. The Melodic Element in Music
4. The Harmonic Basis of Music
5. The Polyphonic Element in Music
6. Form and Design in Music
7. Acoustics in Music
8. Expression and Interpretation in Music

FROM SONG TO SYMPHONY

A Manual of Music Appreciation

Second Year BY PROF. DANIEL GREGORY MASON

1. The Folksong
2. The Art Song
3. Opera and Oratorio
4. Piano Music (The Smaller Forms)
5. Piano Music (The Sonata and Concerto)
6. Chamber Music
7. Orchestral Music (The Classic Period)
8. Orchestral Music (The Modern Period)

MUSICAL INSTRUMENTS

Third Year BY DR. EDGAR STILLMAN KELLEY

1. Primitive and Oriental Instruments of Percussion
2. Primitive, Oriental and Mediæval Wind Instruments
3. Primitive, Oriental and Mediæval String Instruments
4. The Organ
5. The Piano and its Predecessors
6. The Violin Family
7. Wind Instruments
8. The Modern Orchestra

EPOCHS IN MUSICAL PROGRESS

A Manual of Music History

Fourth Year BY PROF. CLARENCE G. HAMILTON
(To appear in 1926)

1. Primitive Music
2. Mediæval Music
3. The Polyphonic Period
4. The Classic Period
5. The Romantic Period
6. Music in the Nineteenth Century
7. Music Today and Modernism
8. Three Hundred Years of Music in America

UNIVERSITY OF ARIZONA
LIBRARY

MUSIC TYPIFIED

From *Margarita Philosophica*, 1504

MUSICAL INSTRUMENTS

BY

EDGAR STILLMAN KELLEY

AUTHOR OF *Chopin the Composer*

MT
6
N2

Third Year

OF

A STUDY COURSE

IN

MUSIC UNDERSTANDING

ADOPTED BY

The National Federation
of Music Clubs

THE PRESS

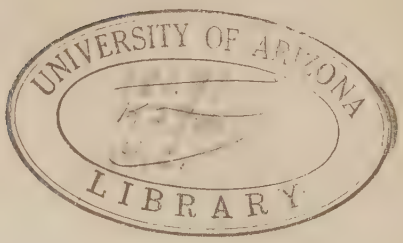
BOSTON: OLIVER DITSON COMPANY

NEW YORK: CHAS. H. DITSON & CO. CHICAGO: LYON & HEALY, INC.

LONDON: WINTHROP ROGERS, LTD.

MADE IN U. S. A.

1925
Copyright, MCMXXV, by Oliver Ditson Company
International Copyright Secured



TO

MRS. FRANK A. SEIBERLING

129487

PREFACE

In the two preceding books of *A Study Course in Music Understanding* the student has first been enlightened regarding the basic elements of music, for without a knowledge of these fundamentals his after study would be hampered and hazy; and, in the second book, he has been led step by step in a graphic survey from the most primitive types of musical art to the more complex modern forms.

In this, the third book, the author's pleasant task has been to describe the various instruments through which music has found its ever growing richness of expression, and to sketch the gradual development of these instruments from the primitive tom-tom to the splendor of the modern organ and the many-voiced symphonic orchestra.

The author is happy indeed to contribute a volume to this *Study Course*, the first planned series of correlated textbooks on the understanding of the subtlest of all the arts—Music, and as a tribute to the woman into whose mind first flashed the idea of such a series of books he has gladly dedicated this work. He wishes, furthermore to express his appreciation of the helpful collaboration of the Editor of this Course of Study.

Edgar Stillman Kelley

Oxford, Ohio
May 14, 1925.

CONTENTS

CHAPTER		PAGE
	Introduction	1
I.	Primitive and Oriental Instruments of Percussion	5
II.	Primitive, Oriental and Medieval Wind Instruments	30
III.	Primitive, Oriental and Medieval String Instruments	59
IV.	The Organ	83
V.	The Piano and its Predecessors	108
VI.	The Violin Family	136
VII.	Wind Instruments	164
VIII.	The Modern Orchestra	197

INTRODUCTION

"Look how the floor of heaven
Is thick inlaid with patines of bright gold.
There's not the smallest orb which thou beholdst
But in his motion like an angel sings,
Still quiring to the young-eyed cherubins.
Such harmony is in immortal souls;
But whilst this muddy vesture of decay
Doth grossly close it in, we cannot hear it."

Shakespeare

When the layman, assisted by a modern telescope, contemplates the almost inconceivably vast flames radiating from the sun, or obtains a view of the whirling rings of Saturn, he is not only awed by the spectacle, but apprehends the existence of celestial vibrations of incalculable magnitude and intensity.

During the past century, scientists have come to the conclusion that the elements found upon our planet exist in all the heavenly bodies, and believe that this Unity of the Universe is further emphasized by the manifestations of the laws of gravity, heat, light, etc. in the various members of our solar system. If this unity be granted, it seems as though we might safely assume that the laws of acoustics that obtain upon our globe hold good in other worlds than ours and that sound is as eternal as vibrant matter.

This view seems to have been entertained by the ancient Hindus, who believed that before the creation of the world, an all-pervading sound 'Om' rang through space. Again in the Book of Job, we read that "the Morning Stars sang together," while the Greek philosophers cherished a theory

that the tones engendered by the revolutions of the various planets, resulted in the Music of the Spheres.*

The Beginnings of Terrestrial Music

From the earliest emotional consciousness of primitive man, there was doubtless (as is the case with birds and animals), some sort of vocal expression. As the range of emotions increased, there would arise a corresponding need for a wider range of expression, probably shown in greater vocal flexibility and compass.

In order to further extend his powers of expression, man was led to the invention of apparatus producing *noise*, and later to such devices as created definite tones. When, subsequently, he had succeeded in fashioning instruments yielding a series of tones similar in quality but varying in pitch, he found himself in the domain of art.

Mystic Origin of Musical Instruments

So unusual was the music evolved from these instruments and so far did it exceed all known sounds in nature in its power to awaken the subtler emotions of man, that a reason for its strange influence was sought.

When certain phenomena are ascribed to inadequate or unrelated causes, we have what is termed *superstition*. But when superstition is idealized or expressed in terms of poetry, we have what is known as *myth*. No wonder therefore that various peoples, on emerging from primitive conditions, forgetting the slow and painful evolution of their tone-producing devices, should believe them to be of supernatural origin. Indeed an interesting treatise might

*The recent marvellous achievements in the realm of radio suggest the possibility that in course of time, man may devise some means of gathering certain vibrations of these heavenly bodies, rendering them audible to earth's inhabitants despite their "muddy vestures of decay." (See an article entitled "Listening to the Stars" in the *Scientific American* for November, 1924.)

be written on the Mythology of Music. Thus in India, their most ancient stringed instrument, the Vina,* is regarded as the gift of the Goddess Siva. The Chinese are in like manner indebted to the phoenix-like bird Foung-hoang for their five-tone scale, while the tones of the King† so ravished the ears of Confucius that for three weeks he lay in a trance. In Greece the precocious Hermes, when only a few hours old, formed a Lyre from the back of a turtle and three sinews, and presented it to Apollo, to appease the wrath of the Sun-God, whose oxen he had stolen. The nymph, Syrinx, on being chased by the God, Pan, escaped only by being transformed into a group of reeds. Pan seized her in that form and showed his lasting devotion to her by breathing beautiful airs upon the instrument that bears her name, Syrinx, although perhaps more often termed *Pandian Pipes.* The power of instrumental music is nowhere more intensely suggested than in the story of Orpheus, who, with the Lyre presented by Apollo, moved not only beasts, but the trees, rocks and the inhabitants of Hades.

In the New World, similar conceptions of the divine source and character of musical instruments are in evidence. Robotham says that a century ago, the Drum was the only object of worship from the Orinoco to La Plata, while Alexander von Humboldt tells of certain tribes near the Orinoco, who have no idols but the *Botuto,* the Sacred Trumpet. In North America, the religious character of certain musical functions, is familiar, the Zuñis, in fact, possessing a special god of music, *Paŕyatamu.*

Control of Sonorous Vibrations

By means of instruments it became possible to produce sounds quite distinct from those abounding in Nature. In

*See Page 73, 74.
†See Page 21, 22.

the later development of such instruments, tones were generated far beyond the range of the human voice. Thus did man acquire the control of *sonorous vibrations.* In other words, the number and character of such vibrations as produce sound, were gradually so regulated by means of suitable instruments that they gave forth any given pitch, intensity or tone color (clang-tint or timbre).* The chapters that follow tell the story of this interesting development and mastery.

The Ultimate Import of Musical Instruments

For a long period these inventions served merely to accompany the voice. Even in choral works, the instruments doubled the various parts (soprano, alto, tenor and bass), simply reinforcing them and supplying interludes. But, at length, the psychic moment arrived when these accompanying factors were able to perform independently. Then, and *then only*, was it possible for Music to rank with the sister arts—Poetry, Painting, Dancing, Sculpture and Architecture.† Obviously Music could only be termed "absolute" or "abstract" when it was sufficiently developed to exist entirely dissociated from the text employed in song and chorus, where the composer aims to intensify through the agency of tones the meaning of the words.

Richard Wagner once said, "God denied the Germans the voices of the Italians, but granted the former the power of expression through the medium of instrumental music." This beautiful aphorism indicates why the opera was born in Italy, while the symphony is a native of Germany.

*See Gehrkens' *Fundamentals of Music,* Chapter VII.

†It would be more informing if, instead of the term "fine arts" we should substitute "the beautiful arts" after the manner of the French (*les beaux arts*) and the Germans (*die schönen Künste.*)

Chapter I

PRIMITIVE AND ORIENTAL INSTRUMENTS OF PERCUSSION

"A talent for Art is rare, but to nearly everyone is given the ability to appreciate the masterpieces."
—*Plato.*

An Evolutionary Parallel

ANTHROPOLOGISTS have called attention to the parallel existing between the development of the individual man and the evolution of the human race. Thus the infant affords a type of the prehistoric ancestor moving about on all fours. The boy with his tendency to gratify every need and whim, even when it involves cruelty, resembles the savage state. The youth with his fondness for finery, may be compared to the barbarian, while the cultured man represents the people of high civilization. A corresponding analogy may be traced between the growth of musical taste in the individual and that of the species.

Outline of Instrumental Evolution

Accordingly, we note that the delight of the infant in sheer noise (produced by rattles, drums, etc.) cor-

responds to the taste of the savages, who first fashion instruments of just this type. As a boy rejoices in whistles, fifes, etc., which produce *definite tones,* so we find the barbarous tribes taking pleasure in the music afforded by instruments of similar nature—Pan-pipes (groups of whistles), rudimentary flutes, horns, etc. In the youth, as his discernment for pleasing succession of tones (melody)* is developed, he cultivates the Banjo, Guitar, Mandolin, Cornet, Flute, etc. In like manner, the semi-civilized peoples devote themselves to the tone-producing media of similar kinds—harps, lutes, dulcimers, horns and viols. Finally, on reaching maturity, the man apprehends the finer qualities of musical art and learns to appreciate combinations of melodies or voice parts (counterpoint in its broader sense), combinations of tone-groups (harmonies and modulation) and combinations of instruments (orchestration). Here the individual has reached the stage representing a people who employ instruments of the highest degree of perfection, capable of expressing the ideas of the great masters.

Influence of Environment

One of the features of modern biology most fascinating to the layman, is that relating to the influence of environment upon a given type of plant or ani-

*See Gehrkens' *Fundamentals of Music,* Chap. III.

mal.* Not only do our zoological and botanical gardens afford excellent illustrations of this law, but all nature abounds in interesting specimens. This same principle is seen to hold good in the realm of art. Hence the lover of architecture, as he inspects the Gothic structures in different regions, finds his enjoyment enhanced by noting the modifications of the forms of various edifices to suit the needs of the respective localities. It is also interesting to observe the employment of such building material as the situation affords. Sometimes these variations are quite marked. Thus the cathedral at Milan is constructed of white marble, that at Cologne of gray granite, while those at Wells and Chester are built respectively of yellow and red sandstone. In like manner, the student, in contemplating a collection of musical instruments will experience an additional pleasure if he learn to appreciate the influence of the environment upon all characteristic specimens. For example, the department devoted to trumpets and horns will show that, in their efforts to create instruments with greater carrying qualities than the human voice for the purpose of signalling on the hunt or in battle, those peoples dwelling near the seacoast naturally

*An experience of the author may possibly be worthy of mention. While travelling in England, he visited the ruins of King Edgar's palace at Chester, and was permitted to gather as relics a few sunflower seeds, sending some to friends in Wisconsin, others to Florida. The former grew to the usual size, while the latter, owing to some dwarfing influence of the soil, attained a height of only twelve inches, but matured and went to seed.

enlisted the services of sea shells, while inland tribes were led to employ the horns of goats, rams, oxen, antelopes, etc.

In such repositories, the variations of a given type, such as flute, trumpet, or viol, are as striking as the characteristic features of the different species of rose, orchid, pine or maple exhibited in our botanical gardens.*

Survivals

Scientific authorities show how Australia, in the far remote past, was connected with the mainland of Asia, and since the severance of this unique island from the continent, its flora and fauna have failed to keep pace with the evolution of kindred types in other parts of the globe. Hence the aborigines correspond to the Paleolithic man of Europe, while the duck-bill, kangaroo, snake-turtle, etc., found only in Australia, are survivals from former periods.

Due to their isolation from the progressive western nations the peoples of the Orient have maintained their ancient culture in many respects in the same condition as it existed thousands of years ago. For this reason it has been considered advisable in outlining the history of the development of musical in-

*A careful inspection of such collections is earnestly recommended. The most notable collections in this country are the Crosby Brown Collection in the Metropolitan Museum of Art, New York; the Mason Collection in the Boston Museum of Fine Arts; the Stearns Collection, University of Michigan; the Steinert Collection at Yale; and the Frismuth Collection, University of Pennsylvania.

struments, to group the inventions of the Orientals with those of the more primitive peoples, the Asiatic survivals taking their place midway between those of man's infancy and his mature methods of "controlling vibrations."

In surveying the vast field open to a writer on musical instruments, it is obvious that in order to bring it into line with the other volumes of this series, it will be necessary to exclude all discussions of tone-producing devices that are not of vital interest at the present day. The effort has been made to confine this treatise chiefly to such instruments as are employed in our concert and operatic orchestras, in the church and home circle. The opening chapters deal with the primitive experiments while the subsequent sections treat of the highly developed modern instruments, which are but the realizations of the vague visions cherished by the primeval devotees of music.

Classification of Musical Instruments

Following the probable order of their appearance in history, we may place all instruments—devices for throwing the air into vibration—under three general heads:

A. Percussion instruments — including not only those that are struck (Lat. *percussio*), but also such as are rubbed or shaken to produce vibrations.

B. Wind instruments.
C. Stringed instruments.*

Obviously this grouping simply indicates in the broadest possible manner the general periods of musical culture, inasmuch as they overlap in different ways in different countries. Some writers believe that stringed instruments were invented before the wind, but there seems to be no reasonable doubt concerning the precedence of the instruments of percussion.

Instruments of Percussion

This class is divided into two distinct groups:

a. Instruments with *indefinite* pitch
b. Instruments with *definite* pitch

Group *a* comprises by far the great majority of instruments used by savage and primitive peoples, for not only does the *indefinite* pitch most readily and completely satisfy the infantile appetite for *noise*, but the various species are relatively easy of construction.

To attempt in a compact treatise like this, to give all the sub-divisions of each species, would but lead us through a labyrinth of weird-sounding names, showing a multitude of methods and materials employed in the creation of devices, the ultimate object

*For the student's convenience, the comparison of man's development with that of the species, may be employed once more, and the above periods designated thus: *a*, Infancy—Rattle and Drum; *b*, Boyhood—Fife and Cornet; *c*, Youth and maturity—Mandolin, Violin, and Piano.

of which has been to produce the same or kindred results. It will suffice to touch on the most significant representatives of the leading groups.

Instruments of Percussion with Indefinite Pitch

The most important under this heading are such specimens as are more or less related to the twelve types with which we ourselves are familiar:

1. Rattles
2. Notched Sticks
3. Crickets (*Schnarren*)
4. Castagnets (Bones, Clappers)
5. Drums beaten with sticks
6. Hand Drums
7. Tambourines
8. Bass drum—
9. Gong (*Tam-tam*)
10. Cymbals
11. Turkish Crescent
12. Triangle

1. The general structure of the Rattle requires no elaborate explanation, as it simply implies some form of receptacle in which certain hard substances are so placed that they can be shaken against the sides to produce noise. But a very long list of the varieties to be seen in our museums, afford us numerous striking specimens. In Africa we find them made of gourds in which are placed pebbles or gravel. In Mexico they sometimes consist of a string of large moth cocoons, containing bits of gravel, sometimes of pottery, red, gray, light brown, etc. A curious feature of these ancient Rattles and whistles of the Aztecs is that they often take the forms of the various

deities of ancient Mexico, each householder being allowed a certain number of idols according to his rank. Certain lighter forms of Rattles were worn about the calves of the legs; others were arranged to be worn as anklets. In British Guiana, one form is made from a large bamboo tube in which are placed nut shells or fruit pits. The North American Indians in addition to the numerous devices mentioned above employ others of quite a different type, such as, wooden rods to which are attached bits of black horn, so that the rattling is produced on the *outside* instead of from within the instrument; a circular frame of wood with skin stretched over it; bracelet Rattles worn on the wrist; Rattles of deer's toes, Rattles of rattlesnakes, etc.*

2. The boy running along the sidewalk, holding a stick so that it shall strike successively all the pickets in the fence, has unconsciously hit upon the principle of the Notched Stick with Scraper, classed sometimes with the Rattles. During the past two thousand years or more, quite a variety of this kind of noise-maker has been produced in many countries. In ancient China a large Notched Stick in the form of a recumbent tiger with many saw-like teeth on its back, was employed in the Confucian ceremonies.

*Wm. Strachey in his *Historie of Travaile in the Virginia Brittania,* (1610-1612), speaking of the music of the Indians of Virginia says: "Their chief instruments are rattles made of small gourdes or pompion shells, of these they have base, tenor, counter-tenor, meane and treble; these myngled with their voyces, sometymes twenty or thirty togither, make such a terrible howling as would affright rather than give pleasure to any man."

It was called the *Yu*, and at certain points in the service, the tiger was struck three times on the head with a bamboo beater, which was then rapidly passed over the back. A similar instrument called the *Gyo* is used in Japan.*

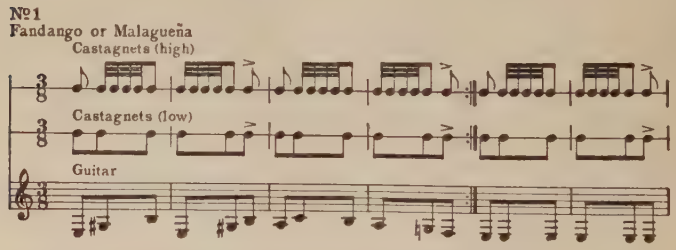
3. In order that man might revel in a continuous rattling, the principle of the Notched Stick was applied to a wheel about which the stick could be revolved *ad libitum.* This apparatus is what we call a Cricket (German *Schnarre*), which Sachs suggests may have originated in India where it has long existed as a toy.

4. Another probable heritage from Asia is the pair of Castagnets which we instinctively associate with Spain. But when we recall the great influence of the Moors since the seventh century upon Spanish architecture, music and customs, it is easy to see that this popular instrument of the Moors early found a home in the Iberian Peninsula† where the art of performing with them reached such a high degree of perfection that instruction books have been published which reveal astonishing possibilities of the Castagnets. It is usual to hold a pair in each hand, the larger (the male) in the left to give the heavy accents at the beginning of each measure; the smaller (the

*Sachs even suggests an earlier introduction by the Phoenicians.

†The name, Latin *Castania*, Spanish *Castañeta*, was suggested by their resemblance to a pair of chestnuts or to the material of which they are made.

female) in the right to execute the more rapid rhythm, as may be noted in the following *Fandango* or *Malagueña*, given by Gevaert, who says that after the close there is a verse sung and with its last note the dance movement begins anew and this formula is repeated several times.

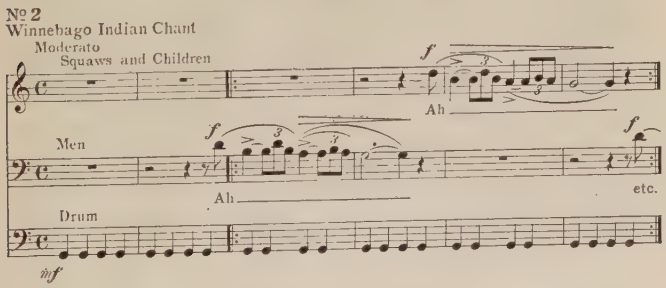


Many will recall the Intermezzo between Acts III and IV of *Carmen*, where Bizet has beautifully idealized this coloring of Castagnets and Guitar. (See also the comment in Chapter VIII, p. 214.)

5. An entire volume might be filled with representations of the multitude of different specimens of Drums. Probably the first effort to produce noise by means of beating with a stick was upon another piece of wood, which is the case with the Chinese *Sack-wo* or wood-drum. The next step is the covering of a gourd or tube of bamboo or other hollow resonator with skin of some sort, then we have the *Ti boatt* of the Chinese. This was a great advance in the art of drum making. Throughout the more cultured countries of Asia as well as among the savage tribes of Africa, America and the Isles of the Pacific,

the Drum is employed as a powerful stimulant to the warrior in battle, and in many forms of religious exercises where the object is to drive away the evil spirits; it is a feature not only in the dances and incantations of the priests and medicine man, but the smaller Hand Drums and Tambourines accompany the dances of houris and nautch girls—adding poignant rhythms to purely vocal numbers. The Saracens utilized the noise of their Drums to frighten the horses of the enemy.

As a boy the author was deeply impressed by the singing of a long procession of Winnebago Indians as they entered his native town to take part in a Fourth of July celebration. The phrase was sung twice by the men, then twice by the squaws and children, then again by the men and so on, the drum



beat continuing throughout. The Drum consisted of a skin covering a round hoop of wood, looking like a modern kettledrum without the kettle.

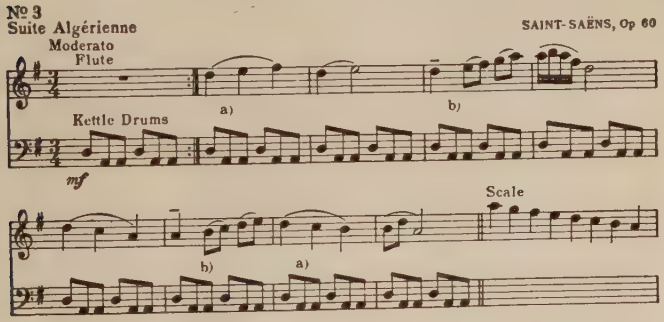
But the monotonous tapping that blends well

with these peaceful measures would in the course of time become tiresome to the crudest mentalities. As the Drum possesses only one available tone (or noise-quality) the only escape from this oppressive monotony is to vary the intervals between the strokes, thus producing rhythm. This is exactly what is done by these simple people, who sometimes develop their percussive art to such a fantastic extent that to the uninitiated it is as difficult to comprehend as is a fugue to many amateurs.

INDIAN DRUM—THE DANCING LESSON
Taos Pueblo, New Mexico
(*Fred Harvey, photo.*)

I recall a meeting of the *Internationale Musik-Gesellschaft*, in Berlin, at which Prof. Carl Stumpf, at that time President of the University, delivered an

able address on "The Beginnings of Music." Among the illustrations was a song by a native of West Africa, which he accompanied on a hand Drum. The cross rhythms and apparent total discrepancy between the vocal and the instrumental parts were baffling indeed. Saint-Saëns in his *Suite Algérienne* has happily imitated this African rhythmic complex. (See No. 3). The student on playing it will find it



none too easy at first. Then if interested in thematic development he will observe the relationship of motives a—a (the second inverted) and b—b, the first in the tonic, the second in the dominant. Finally if interested in modes or scales he will see that it is written in the *Hyper-mixolydian* mode (See Grove, article *Mode*).

7. A familiar kind of Hand Drum may be found in our Tambourine, which by virtue of its jingles, combines the features of both Drum and Rattle. This type of instrument was known in ancient times and is

depicted in many scenes from the Orient, classical Greece and Rome.

The Tambourines were in great favor not only throughout the Orient but also in Europe during the Middle Ages accompanying songs and dances and were used in connection with the tricks of Mountebanks and Jugglers.* They also amused the folk with all sorts of tricks with their Tambourines, throwing them up in the air and catching them again, as was the wont of the end men in our old time negro minstrels. In this connection, it might be mentioned that the fascinating rhythms of the Bones (clappers or castagnets) of the "other" end men, as well as of the double clog-dancers was closely akin to the achievements of the hand-drummers from West Africa above referred to.†

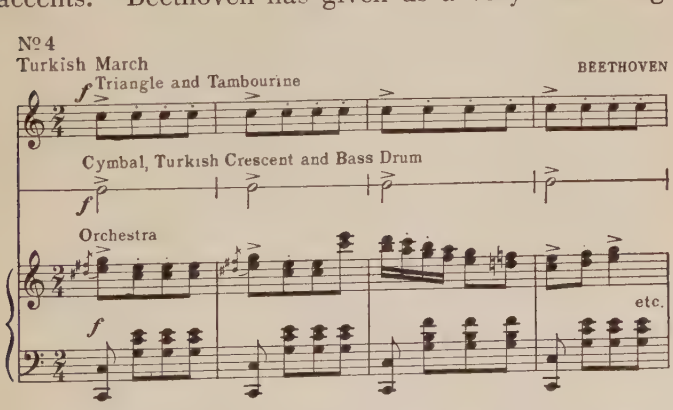
8. The Bass Drum (9) Gong (Tam Tam) and (10) Cymbals are all of them familiar instruments and are to be discussed under appropriate headings, but are mentioned here for the sake of completeness as they are all peculiarly Oriental instruments. The Bass or Great Drum we have borrowed from the Turks; the Gong from the Chinese; the Cymbals from the Turks again, although very remarkable ones

*A feature of Buffalo Bill's *Wild West Show* was a group of Arabian acrobats, whose performances were accompanied solely by the rhythm of Castagnets.

†Herbert Spencer states that "our pleasure in a picnic consists in a temporary return to the savage stage." He would doubtless have demonstrated that the fondness for what is termed "jazz" is but a casual reversion to musical savagery.

(much larger) are found in China. It is a singular fact that these brass instruments—Gong and Cymbals—are nowhere made in such perfection as in China and Turkey.

11. The Turkish Crescent (also called curiously enough, *Pavillon chinois*) is a long staff, which penetrates (so to speak) several metal plates from which hang numerous small bells. The whole is surmounted by a crescent and is carried by the drum major who strikes the ground at the heavy beat of each measure, while marching at the head of the regiment. (12) The Triangle* in the meantime keeps up an uninterrupted series of regular strokes, while the Cymbals and Drums augment the heavy accents. Beethoven has given us a very clever sug-



*This name is so clearly descriptive of the little steel rod bent in triangular form and struck with a steel beater that it is difficult to realize how long it had maintained during the middle ages the shape of a trapezoid and so had *four* sides instead of three.

gestion of this military movement in the *Turkish March* from his music to the play *The Ruins of Athens*. (See No. 4. The original key is *B♭*).

Instruments of Percussion with Definite Pitch

Hector Berlioz in his epoch-making treatise on Orchestration, refers to the "occult harmonies" resulting from the simultaneous clicking of the muskets of an entire regiment when at drill. This idea seems fanciful to many, and yet it has a germ of scientific truth, for the pitch of the many muskets must vary in some minute degree. Akin to this is the performance of the Sioux Indians with wooden tappers as described by Mr. Robert O. Sweeny who says, "I have heard the tappers on a large number of tomahawks make wonderful music. By moving the fingers along the under side of the blade of a tomahawk, the note is changed." The pleasure derived from "changing the note" indicates a desire to extend the tonal range even with this crude apparatus.*

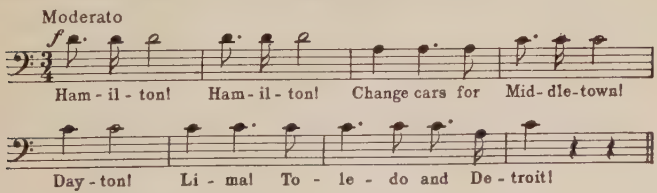
The moment we come to the inspection of instruments with definite pitch, we find evidence of a higher grade of intelligence than that required to

*Noise, as the student will remember, is the result of *irregular* vibrations; sound is produced by *regular* vibrations. This fact should be borne in mind when listening to vocal as well as instrumental productions. It will be noticed that a well "placed" tone always carries better than one indifferently uttered, even when forcibly emitted.
As the train from Indianapolis to Cincinnati arrives at Hamilton, a

produce those of the preceding class, for not only does the pleasure derived from a series of tones denote a finer esthetic sense, but a certain degree of mathematical intuition is implied. Gevaert, the distinguished authority on the music of the ancients, says, "The perception of the relationship of a tone to its octave indicates the beginning of the art of music."

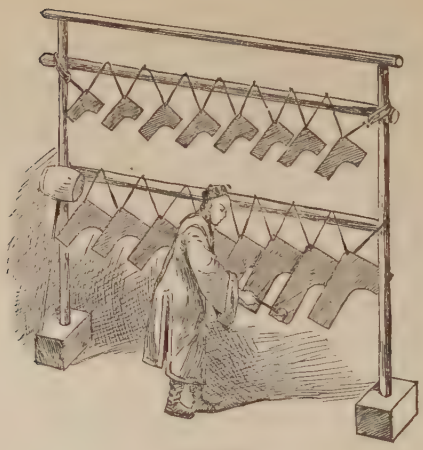
Probably one of the earliest attempts to co-ordinate a series of tones more or less related, was the Pien-King or *Pien-ch'ing* (stone chime) of the Chinese (4500 or 5000 years ago) which consisted of a series of sonorous stone plates (usually sixteen) suspended by tendons or strings from a couple of horizontal bars, the performer striking these plates with a hammer. The stone plates which gave the tones of the Chinese scale were afterwards superseded by plates of metal as shown in the illustration. These plates of metal in turn made way for a series of bells (without tongues) also struck with a hammer.

certain official calls out with measured resonance:



(Incidentally observe how the rhythmic structure makes for clarity of statement.)

Another trainman yells as though one doubted his veracity, but as he employs mere noise, his announcement is far less intelligible.



PIEN-KING

Bells

In other countries of the Orient, a similar series of experiments preceded the casting of copper bronze and other metallic bells with tongues or clappers similar to those that have been in vogue throughout Europe for several centuries. Among the most remarkable proofs of ancient accomplishment in this field of activity is a finely modeled Assyrian bronze bell, which was made eight or more centuries before the Christian era.

The universal employment of bells of all sizes in connection with religious services, from those small golden bells worn on the robe of Aaron to the heavy chimes of the great cathedrals, betokens their peculiar spiritual nature.

Prehistoric hexagonal bells have been excavated in Iceland, that curious repository of legendary lore and linguistic traditions. During the Middle Ages the bells were regarded almost as personalities and were believed to possess the power of averting calamities caused by the elements, and in a more practical way were rung to frighten away the Turks who regarded them as their most dangerous foes. Whoever ascends the tower of Notre Dame in Paris, or the spire of the Freiburg Minster and reads the inscriptions cast in the bells, many of them dedicated to individual patron saints, cannot fail to appreciate the power they have long exerted over the imaginative masses.

In China bells of enormous size hang in the towers and doubtless are still used to drive away demons. In Peking alone there are seven, each weighing 120,000 pounds. But it is in Russia that the enthusiasm for bell-building reached its greatest height. The most remarkable, of course, being the "great bell" which was cracked during a conflagration in the Kremlin, and was long used as a chapel—the interior being 22 feet in diameter and over 21 feet in height.

Long before the discovery of America the Aztecs employed bells of pottery in their religious services. Those made of metal now found in Mexico are of Spanish origin.

Although these gigantic tone generators mentioned do not come under the heading of orchestral instru-

ments, their assistance is sometimes invoked by composers of the first rank, rarely however, with success. (The bells in *Parsifal* are still something of a problem.) But the theme is a fascinating one, and a program might well be devoted to a rehearsal of the influence of bells on history, mythology, poetry and music, illustrated by excerpts from Schiller, Poe, Longfellow, Tennyson, Wagner, etc.

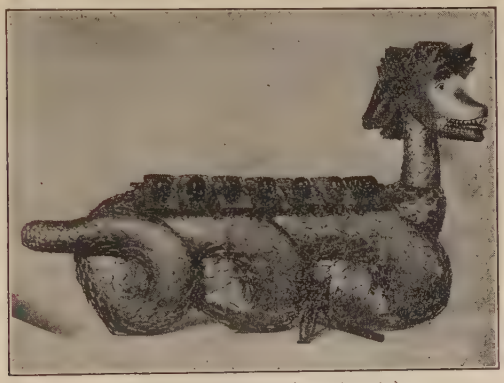
Of smaller specimens, such as were used by the once celebrated Swiss Bell Ringers there are numerous instances of successful charming achievement.

Xylophone

That it is possible to evoke definite tones from substances other than stone or metal, sometimes of true clarity, was demonstrated long since in regions widely remote. As the predominant material has been wood, they are classed under the general caption *Xylophone* (Greek *Xylophonon*), literally "wood sounder"—implying a row of parallel bars of wood, varying in length so as to produce a scale when played upon with small mallets. In the Crosby Brown collection at the Metropolitan Museum, New York, one sees a rich variety of types with the sounding bars not only of wood but of bones, turtle-shells and metal.

An elaborate example from Java called a *Saron* is

a carved dragon of wood, four feet in length, supporting on its back seven bars of wood.



SARON FROM JAVA (*Length 4 ft.*)
(*Crosby Brown Collection*)

The *Marimba* of Central America, is a wooden frame supporting twenty-three slabs of wood. Under each slab is a tube of bamboo which serves as a resonator or tone amplifier, and this feature has been adopted by our most modern American Xylophone makers.

Kettle Drums

That Kettle Drums—something like those to be found in any orchestra—have long been used in Oriental countries is not strange, seeing that our American Indians and other primitive tribes possess drums somewhat similar. But the fact that the Orientals employ them *in pairs,* so that they are definitely

tuned to the tones of the tonic and dominant—*that* is something remarkable and worth remembering. It shows that whatever the scale, whether it contain five, seven, thirteen, seventeen, or twenty-two tones, there will be, as Helmholtz has shown us, two tones common to all—the *tonic* and the *dominant* "whose relationship is so strong that it makes itself felt in all known systems of all peoples."* In the light of this statement it is significant that it does not hold true of the whole-tone or hexatonic scale where the fundamental chords of tonic and dominant are impossible.

Orchestra of Ninevah

*Helmholtz *Tone Sensations*, Part 3, Section 14, p. 422. See also the comments on the Natural Scale in connection with No. 8, p. 47.

Questions for Review

1. State the difference between *noise* and *sound*.
2. What is essential to the production of definite musical tones?
3. In the development of the art of Music, what was necessary to render it independent of Poetry or the Dance?
4. Why do primitive people associate music with supernatural phenomena?
5. Give instances of the supposed miraculous origin of music and musical instruments.
6. What class of instruments do we find employed by the savage peoples?
7. What are in use among the semi-civilized?
8. What instruments are associated with the highest types of mankind?
9. Give illustrations of the influence of the environment upon the character of instruments in various localities.
10. What are the two great divisions of percussion instruments?
11. Name examples of each with their chief characteristics.
12. State where or among what peoples the more important types are used.
13. Mention compositions of European composers who have introduced them as local color.
14. Tell something of the character of the Bells of different countries and how employed.
15. What important tones does Helmholtz tell us are common to the scales of all cultured peoples?

References

Aalst	Chinese Music.
Engel	The Music of the Most Ancient Nations.
Engel	Musical Instruments, (London, 1908).
Sachs	Handbuck des Musikinstrumente.
Galpin	Old English Instruments of Music, Chapters I, II.
Hamilton	Outlines of Music History, Chapter I.
Pratt	History of Music, Chapter I.
Naumann	History of Music, Volume I.
Stanford and Forsyth	A History of Music, Chapter I.
Grove's Dictionary	*Articles*: Castanets, Cymbals, Drum, Triangle, Xylophone.

The following named illustrated catalogs will be found helpful not only in this but in later chapters. (Unmounted photographs of instruments can be purchased of the Boston Museum of Fine Arts and the Metropolitan Museum of Art, New York.)

Boston Museum of Fine Arts, Bulletin No. 91 (Oct. 1917). Describes with many illustrations *The Leslie Lindsay Mason Collection of Musical Instruments.* (To be had of the Museum for 10 cents.)

Keyboard Musical Instruments in the Crosby Brown Collection (Metropolitan Museum of Art, New York, 1903).

The Musical Instruments of Oceanica and America (Metropolitan Museum of Art, New York, 1914).

Loan Exhibition of the Worshipful Company of Musicians (London, 1904).

ILLUSTRATIVE RECORDS AND ROLLS

Records:

V—Victor; B—Brunswick; C—Columbia; E—Edison.

Rolls:

A—Ampico; D—Duo-Art; M—Melodee; Q—QRS.

Music Mentioned in Chapter I

Beethoven—Turkish March from *Ruins of Athens* V, B, E; A, D, Q.

Bizet—Aragonaise from *Carmen* V, C.

Saint-Saëns—Suite Algérienne V; D.

Additional Records

Bells, Planquette—Legend of the Bells V.

Chinese Drum V. (42394a).

Indian Gourd Rattle—Medicine Song V. (17611).

Indian Tom-Tom—Navajo Indian Songs V.

do Penobscot Tribal Songs V.

Marimba, Kalman—Sari Waltz E.

Marimba, Valverde—Colombia Waltz V.

Xylophone, Humperdinck—Witches Dances V.

Chapter II

PRIMITIVE, ORIENTAL AND MEDIEVAL WIND INSTRUMENTS

"Music exerts a power that no one can comprehend. This power rises to such a height that the understanding fails to reach it."—*Goethe.*

Wind Instruments

THE boy who amuses himself by blowing across the mouth of an empty bottle, throwing the air into vibration and generating a tone, applies the same principles that were employed by the ancient Greeks when they hollowed out a piece of reed and blew across the top. To vary their pleasure they added other reeds of different lengths and then binding them together, produced the Syrinx or Pan-pipes.* A legend of the Chinese attributes the invention of this instrument to the Emperor Chwen who bound together ten reed pipes

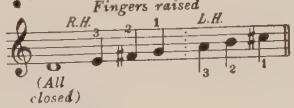
SYRINX

*See p. 3. The Hebrew word *Ugab*, mistranslated "organ" in Genesis 4:21, refers to this type of instrument.

of varying length; and the Chinese today use Pandean pipes of bamboo tubes.*

This precursor of the Organ is found today among the Peruvian Indians of the Andes, the Indians of Bolivia, and those of the New Hebrides who have Pan-pipes of from eight to sixteen tubes of bamboo bound together with strips of cane; while the natives of the Solomon Islands bind together forty to fifty tubes of bamboo graduated in length from one and one-half inches to two feet four inches.

The Egyptians and Arabs simplified matters by taking a single reed pipe and perforating it at the proper distances, rendered it capable of giving a series of tones corresponding to an equal number of separate pipes. In other words, with all the holes closed by the fingers of the player, the tone produced would be the same as though the pipe were the longest of a group. Then beginning with the lowest hole and raising successively one finger after another, thus virtually shortening by degrees the length of the pipe, a constantly ascending series of tones is obtained. (See No. 5).

No 5
Pipe Scale

In China a Flute called the *Wong Seo* is employed, which is held, not straight

*One in the Mason Collection has eighteen small bamboo pipes ranging from one and one-quarter to four and one-half inches. Next to it is one from Southern Europe of nineteen pipes from one to six inches in length.

out in front of the performer, but sideways, as is the manner of our orchestral flutists. It is thus the prototype of our modern *Flauto Traverso.* The Hindu divinity Krishna is often represented holding a transverse flute—the *Murali.*

GREEK AULOS
(Double flute)

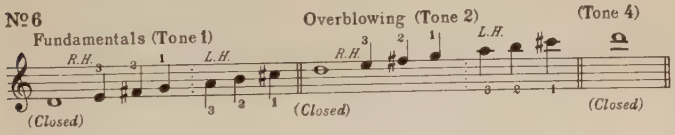
CYPRIOTE
Double flute
(*circa* 600 *B. C.*)

ASSYRIAN
Double flute

Whoever has attempted to blow on Flute, Clarinet, Trumpet or Horn will remember the peculiar result of his initial effort. Probably the first puff was noiseless, or merely a rush of wind through a tube. Another blow produced a tone that soon split, while a third, perchance more violent, gave rise to a ludicrous "tootling" in which two or more sounds were heard, and he wonders how those who have mastered a wind instrument ever produce a creditable tone, to say nothing of a scale.

But a good flutist can easily explain how by closing all the six holes of his instrument (with fingers 1, 2 and 3 of each hand) and blowing steadily, he pro-

duces a certain tone, the fundamental; then by successively raising the fingers (as above mentioned) he obtains the remaining degrees 2, 3, 4, 5, 6 and 7. He will then show how by closing all the holes again and overblowing he obtains a tone an octave higher than the original one. Then, by opening successively the holes as before, he produces all the tones of the second octave up to the seventh of the scale when by further overblowing he generates the tone two octaves above the original tone and completes his scale of two octaves. (See No. 6).



Whistles and Flutes

The art of producing tones by blowing into a hollow piece of wood, reed or bamboo after the manner of the boy with his willow whistle was cultivated by Paleolithic man, who made his instruments of bone. Specimens of bone whistles of that order are to be seen in our museums from various districts of North and South America from Oceanica, as well as from the old world. In fashioning these crude instruments the bones of man as well as of birds and beasts have been utilized, and in order to extend the compass, holes have been provided.

The ancient Aztecs employed pottery in the con-

struction of their Whistle Flutes, which they regarded with great reverence, employing them in their religious ceremonies. Prescott relates how the victim destined to be sacrificed was treated with deepest respect and was attended by a train of royal pages. As he halted in the streets to play some favorite melody, the crowd did him homage as the representative of their good deity. When the hour arrived in which he was to be sacrificed, he observed the established symbolical rite, by breaking a Flute on each of the steps as he ascended the temple. These terrible features of ancient religion are supplemented by others which are so ideal as to contrast most forcibly with them. Engel tells how on the accession of a prince to the throne, he, in a prayer to the God, makes use of the following musical allegory: "I am thy Flute; reveal to me thy will; breathe into me thy breath like into a Flute, as thou hast done to my predecessors on the throne."

INDIAN BOY WITH FLUTE
Taos Pueblo, New Mexico
(*Fred Harvey Photo*)

The finer Flutes in use among the North American

Indians are of this same Whistle type, akin to the Flageolet and are usually made of wood, cane or similar material.

Classification of Wind Instruments

The four groups into which wind instruments are naturally classified are shown in the following table.

TABLE OF WIND INSTRUMENTS

- **A. With simple aperture**
  - (a) Blown directly
    - Pandean Pipes
    - Whistle
    - Whistle flute
  - (b) Blown transversely
    - Flageolet
    - Wong Seo (China)
    - Murali (India)
    - Flauto traverso (Europe)
  - (c) Blown with mouthpiece (Fipple)
    - Recorder (English)
- **B. With reeds, single or double**
  - Zamir (Arabia)
  - DeeDah (China)
  - Shawm (Europe)
  - Bombard (Europe)
  - Clarinet (Europe)
  - Oboe (Europe)
  - Bassoon (Europe)
- **C. With cup mouthpiece**
  - (a) Simple tubes without apertures
    - Horn (prehistoric)
    - Trumpet
    - Post Horn
    - Bugle
  - (b) Chromatic
    - With slides
      - Sackbut (Europe)
      - Trombone (Europe)
      - Slide Trumpet (Europe)
    - With holes
      - Zincke (Europe)
      - Serpent (Europe)
    - With keys
      - Keyed Bugle (Europe)
      - Ophikleide (Europe)
- **D. Organs**
  - (a) Blown directly
    - Chêng (China)
  - (b) Blown by mechanism
    - Hydraulus (Europe)
    - (Water Organ)

To sum up note that Class A are of the Whistle and Flute type with a simple aperture; B, those with either a single or double reed, as the Clarinet and Oboe; C, those of the Horn and Trumpet type with a cup mouthpiece; D, those of the Organ type, blown by mechanism except in their primitive form.

Instruments with Reeds

Whoever has amused himself by taking a leaf or blade of grass between the thumb knuckles of both hands and, blowing forcibly, produced a squawk if not a tone, will have applied the principle of the reed, and his improvised noise-maker will be related to the Oboe, Clarinet and Bassoon.* Instruments of this type, being more complex than anything hitherto mentioned, we can only expect to meet them among peoples of a higher degree of culture. We accordingly encounter few specimens among the aboriginal Americans, excepting in the tribes of the Northwest Coast where, according to Mr. F. W. Galpin, there are Indians of a superior order of intelligence. In the absence of true reeds, they have ingeniously introduced two vibrating tongues of wood.†

*Possibly the reader may have heard in the general tuning of the orchestra before a concert an odd little "squeek-eek-eek." That was the oboist preparing his reed.

†In the meantime let us not forget that the familiar expression "reed instruments," means literally what we say, for the true instruments of that class have always been provided with carefully polished bits of reeds that grow in Southern Europe, the best coming from the Mediterranean shores.

One of the chief charms of old San Francisco was its Oriental character, and among my earliest impressions were the weird strains of music to be heard in Chinatown. One day I entered a very picturesque and impressive temple, where as part of the service a Chinaman stood before the altar blowing an instrument that appeared like a Trumpet and was not lacking in brazen blare, but the motive, which I afterward incorporated in my *Aladdin Suite,* was not of a trumpet-like character.

This phrase no natural Trumpet could play, while the tone quality was more like that of an Oboe. On inquiry I was told it was the *Dee Dah,* the Chinese type of Oboe. It has reeds, but is made with a brass bell, which accounts for its harshness.

Sometime later, while living in New York, making preliminary Oriental studies for the music to *Ben Hur,* I visited the Arabian musicians who played in the Midway Pleasance at Brighton Beach. Aside from the cross rhythms of their Drums (as already noted in No. 3) I was interested in their peculiar melodic progressions and especially attracted to the performer on the Zamir, an Oboe-like instrument with a less violent tone than the Chinese Dee Dah.

While watching the Zamir player, I was forcibly reminded of the fact that the ancient Greeks permitted none but slaves to play wind instruments on account of the facial contortions of the performers. The reason for this was, that the *Aulos*, a Greek instrument of the reed family, demanded such pressure of air through a small aperture, that the cheeks were unduly swollen and performers were obliged to wear bandages to preserve them from injury.* I observed that the Arab had the remarkable faculty of making an air chamber of his cheeks, pressing the wind through the instrument by controlling his facial muscles, in the meanwhile breathing through his nose, so that he was thus enabled to execute long passages without interruption or breaking a phrase.†

The Shawm and Its Relatives

In the absence of definite data concerning early European music and knowing as we do how greatly indebted we are to the peoples of the East, it is not strange that many authorities are inclined to attribute pretty much everything of value to the Orient, Greece and Rome. But, deep as are our obligations to those

*See illustration showing cheek-band on the Cypriote Flute player, p. 32.

†A friend once heard *Tristan and Isolde* in Manchester, England, and was astonished to hear the long sad melody of the shepherd boy (English Horn) in Act III, ten measures or more, played in a single phrase. On inquiring of the conductor, Mr. Hans Richter, he learned that the performer had once been a glass blower and, like the Arab, had learned to *breathe as he blew.*

countries, this does not imply that our Northern ancestors contributed nothing to the world's orchestra.

We have already seen (p. 31) that the inhabitants of regions as widely remote as Bolivia and the Islands of Oceanica had hit upon the principle of the Pan-pipes with no knowledge whatever of its Greek or Chinese prototypes. These and kindred specimens from different countries decorate the walls of our museums, showing that, given the desire to express certain feelings through the medium of music, man will invent the necessary apparatus, using the material nearest at hand.

The word Shawm is familiar to most of us as an instrument mentioned in the King James translation of the *Psalms of David,* and in medieval Europe was used to denote the predecessor of the Oboe, (Fr. *Chalumeau* — Ger. *Schalmei*). Its essential characteristics may be seen in the latter instrument, where the sound is generated by setting in vibration the two flat pieces of thin cane or reed by the breath of the player. The chief difficulty in performing on these double reed instruments consists in the great pressure of air that must be forced through a small aperture. Unless

SHAWM—14th Cent.

the player possess a strong physique, this strain may prove injurious.

The reader who may have listened to music from any Asiatic or African source will doubtless have noticed, first, that it was *melodic*, had no sort of harmony, and second, that there were no adequate bass tones even were the performers inclined thus to accompany their melodies.

At this point it will be well to call attention to our indebtedness to the Medieval Europeans. While the Shawm was in use in the tenth century, and even earlier, it was not until the fourteenth century that it had taken a definite place in the wind-bands of that period. It was then that an effort was made to extend the scale of the instrument and makers began to furnish them in groups so that they could perform music in four-part harmony. The lowest one, the bass, called Bombard (German *Pommer* or *Bombort*) is mentioned as early as 1393 by the poet Gower.

SET OF SHAWMS—17th cent.
Treble, Tenor and Bass (Bombard)

There was also a double-bass Shawm or Bombard that gave the tones an octave below great F.

This taste for harmony shows the influence of the church with its choir and organ and the continually growing richness of the service.

We are all familiar with the term Double-Bass in our orchestras, the lowest of the string group which does indeed often double the bass of 'Cello, etc., in the lower octave, but the real meaning of the expression as applied to instruments of the Shawm, Recorder, Viol, Trombone and Tuba groups consists in the fact that its compass lies largely in that register designated by double capitals, CC, DD, EE or C^2, D^2, E^2, etc.*

The Recorder

The Recorders or Fipple-flutes formed a pleasing contrast to the sharp-toned Shawms and for that reason were also called the *Flûtes douces*, forming as a group the *dulcet* woodwind in contrast to the *reed* group of Shawms and Bombards. Whereas the Shawm was an instrument resembling the kindred Oboe by whom it was later superseded, the Recorder was a kind of Whistle-flute (see p. 33) to which was added a fipple or crooked mouthpiece like that of a Bassoon, but the tone-color was flute-like. Although much in vogue throughout Western Europe, it en-

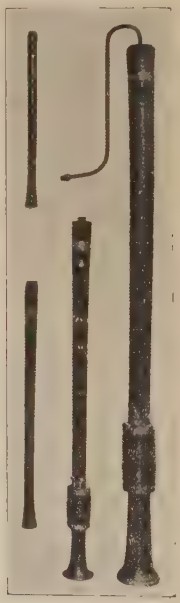
*See Gehrkens' *Fundamentals of Music*, p. 166.

joyed its greatest popularity in England where we find it mentioned by Chaucer (1384), Shakespeare (*Hamlet*), Bacon, Evelyn, and Pepys, the last named being an enthusiastic performer on the instrument.

Like the Shawms, the Recorders were made in various sizes for the similar purpose of playing music in several parts. (See cut).

1. 2. 3. 4.

1. IRISH PASTORAL PIPE 3. FRENCH OBOE
2. ITALIAN FLUTE 4. FRENCH RECORDER
(18th century)



SET OF RECORDERS
(As used c. 1600)

Bass Flutes

There seems to have been a grotesque discrepancy between the size of the Bass Recorder and its feeble

tone. Indeed the ideal Bass-Flute for which composers have long sighed in vain, is yet to be invented, and when it appears it will doubtless be blown by machinery.* The specimens shown in museums and those prepared for recent orchestral experiments seem to have led to no practical results.

Medieval Orchestration

In Wagner's score of *Lohengrin* (1848) we see for the first time in history a grouping of three Flutes, three Oboes, three Clarinets and three Bassoons (the third Oboe playing also the English Horn and the third Clarinet the Bass Clarinet). There are also three Trumpets. The object of employing groups of three instead of two of a kind, as was the custom of the classical masters, was to make it possible to play a complete chord (triad) in a given tone-color. Like all the wonderful innovations of Wagner, this extravagance was greeted with derision by his enemies. But, had they stopped to think, they would have realized that this novelty was a revival of the medieval precedent of presenting a theme or melody by a uniform group of instruments. In the sixteenth century great pains were taken to preserve each section by itself. A large orchestra of 1561 was divided into five groups—first, Violins; second, Cornets; third, Flutes; fourth, Hautboys; fifth, Drums and Fifes;

*See Chapter VII, p. 169.

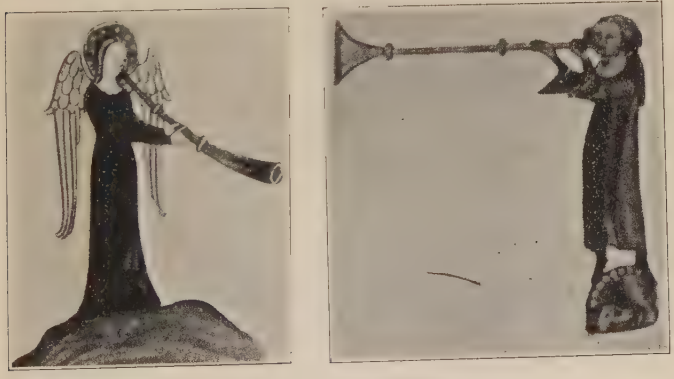
each section performing separately. Indeed a marked effort was made to have the tone-color fit the scene. Thus songs were accompanied by Lutes, Viols and Virginals and other stringed instruments. The various wind groups were used in appropriate scenes. But Wagner did not remain in one color during an entire scene. On the contrary, when the situation demanded it, the transitions were quick and numerous, as were his modulations which he justified by the necessity of expressing the sudden change of mood of the different characters.

The medieval musicians were very cautious in making changes in their methods. Each group (Recorders, Shawms, Viols, etc.) was called a Consort and when one or more instruments of one group played with another Consort, the result was termed *broken* music, an expression frequently used by Shakespeare and others of that day.

Horns and Trumpets

So accustomed are we to employ a certain word to designate a given object that we rarely stop to think whether or not the term is correct or whence it originated. Thus in speaking of the Horns in an orchestra, so filled are our minds with the countless, beautiful, stirring and again terrific themes, to which these modern instruments give utterance, that few of us are mindful of the fact that the ancestral type was the horn of some animal—ox, ram, antelope, or ele-

phant—cut in such manner at the small end that the air could be thrown into vibration. We accordingly find in our museums, specimens showing an infinite variety of shapes, sizes and materials, indicating, as in the case of the Rattles, Drums, etc., their Asiatic, African, American or European origin. Indeed the eminent authority, Professor Sachs,* expresses the conviction that the Luren or Horns from the Bronze Age, unearthed in the Baltic region, were modeled after the tusks of the Mammoth. When that creature became extinct, the instruments were necessarily fashioned from metal as a substitute.



HORN (Early 14th century) TRUMPET

Horns and Trumpets are mentioned here together as the names were long used interchangeably, and

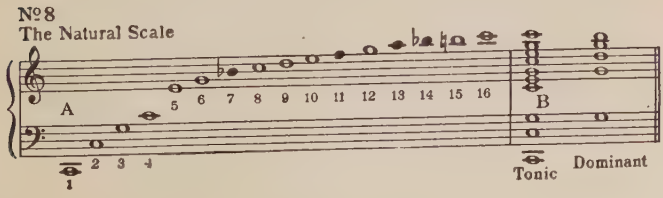
*Prof. Dr. Curt Sachs, Curator, of the collection of Music Instruments in the Music High School, Berlin, *Handbook of Musical Instruments*, p. 248.

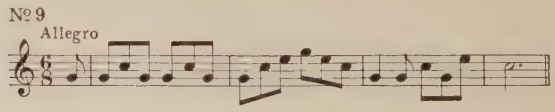
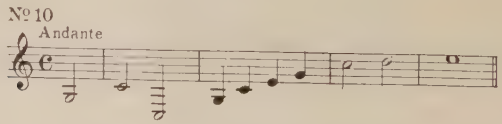
indeed we hear them still so employed by the careless or the uninformed. Roman writers relate that the ancient Britons employed Horns and Trumpets to frighten their enemies and succeeded in terrifying even the Roman legionaries. We read that the War Horns of the ancient Scots were in size about a man's height and could sound an alarm audible six miles distant. This statement would seem incredible did we not find in Wallaschek's *Primitive Music* that "the Maoris with their seven-foot tubes blow with such vigor as to be heard several English miles away."

Like those politicians and debaters whose system of logic consists in talking louder than their opponents, so too did the medieval warriors seek to outdo the enemy in respect to noise. It is not strange therefore to find that the simple Steer-horns of the Crusaders cut a poor figure in the Holy Wars and were outclassed by the brazen Trumpets of the Saracens. Hence the introduction of instruments of this type in Western Europe.

There is ever something awe-inspiring in the voice of the Trumpet. Sublime indeed is the description of the trumpet-sounding of the seven angels in the Book of Revelations, and hardly less inspiring is the Koranic account of the Day of Judgment, when the archangels Gabriel and Israfel are to awaken with their trumpet-calls the souls of the departed from their long sleep. The dramatic and religious power of this ancient instrument is frequently emphasized in sacred

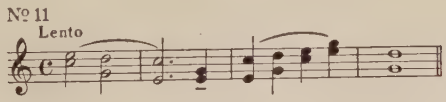
as well as secular history and yet nowhere from Genesis to the Apocalypse nor in other ancient writings is there a hint of its use in connection with the art of music. This musically isolated position of these noble instruments was maintained long after the Christian era. Roland, surrounded by the Paynim hosts at Roncevalles, seized his horn and blew that long, despairing blast that has resounded through the ages. The elf-king Oberon wrought wonders with his magic horn at the court of Charlemagne and yet in spite of such achievements, no trumpeter or horn-player of that age was ever known to take part in concerted music. There were several reasons for this. To begin with, the use of these instruments was regarded as the prerogative of royalty and the nobility. In the next place, the tones produced were too loud and harsh to blend with lyric instruments like the Lute, Rebec, Viol, etc. Then again, the paucity of tone material at their command rendered them hardly desirable comrades in a band or orchestra. By looking at the harmonic series or nature scale, we shall get a better idea of this condition. (See No. 8).



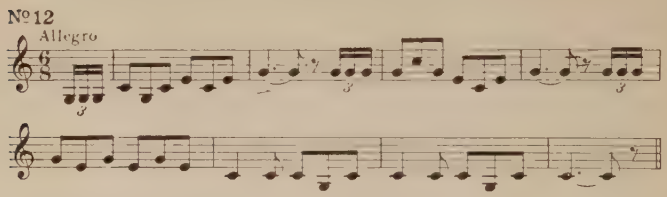
It has been demonstrated in discussing the Wood-wind how, by means of what is termed "overblowing" tones higher than the fundamental (or tone 1 of the Natural Scale) may be produced. In performing upon the primitive brass instruments, this system of overblowing is of great importance for there are no keys that enable one to vary the pitch, and while the extreme low and high tones are seldom available, the tones 3 to 10 are usually to be relied upon. It should be remarked that long tubes or horns are obviously better adapted to generating the lower tones while shorter ones favor the production of the higher. Therefore, short instruments like the Bugle and Trumpet feel more at ease in the upper registers and utter quite glibly motives or calls like the following:*

while the longer tube of the Horn will prefer passages like this:

The possibility of building up a fundamental chord from the tones of the Nature scale, even with the scanty vocabulary of the brass instruments,

*See also motives in Gehrkens' *Fundamentals of Music*, p. 171

doubtless occurred to the Trumpet and Horn players fairly early in the Middle Ages. As the instruments became more perfect, the series of available tones was naturally increased. A glance at the table given in No. 8B will show that two chords could be produced by these brass instruments and these chords are the most vital in all music—the tonic and dominant.

Attention should be called to the fact that those tones indicated by black notes do not correspond with the tempered scales which we employ, and would consequently sound out of tune when played in unison with Oboes, Shawms or Trombones. Hence, when the time arrived for the experiment of combining two or more Horns in harmony it was found that only such passages as the following were possible:

At the present day when we are so accustomed to harmonic richness, these passages do not seem especially attractive, but in spite of this, they represent the foundations of our art of music and themes of this sort were the stock in trade of early and late medieval composers.

As was the case with percussion instruments, variety was obtained by Trumpets and Horns through

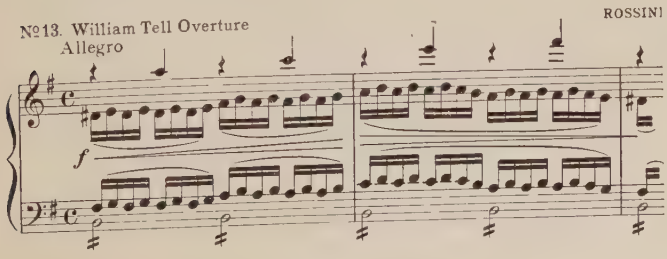
the employment of notes of different lengths, so that their poverty in tonal capital was compensated for by a richness of rhythmic devices. (See No. 12).

As neither Trumpet nor Horn was capable of rendering a major or minor scale, they could not play duets with Viols or Flutes involving passages in thirds or sixths even if they could have modified their tone to make them blend well.

Their natural range, however, was utilized to such good purpose that quite a code of signals was established. Even at the present day the military still employ a large number of calls, several of them being quite familiar, as shown in Professor Gehrkens' chapter already mentioned. Louis XIII of France, like many of his rank, was fond of hunting and invented a call to denote the fox, while Louis XV composed a number of calls designating different phases of the hunt that are still in use.

In this manner, as more and more attention was paid to the hunting or forest horn (French *cor de chasse*, German *Waldhorn*), its melodic possibilities were cultivated and its size and shape modified until it became much the sort of an instrument we now see

in our orchestras. The short horns of animals having been replaced by those of metal, it was easy to lengthen them to produce more tone. Then becoming too heavy, they were curved once or twice for convenience in carrying on horseback.

There are types of brass instruments whose tonal range is even more limited. This is especially true of the Russian Horn, which can yield but two tones—the fundamental and its octave, so that in order to play a scale in *C-major*, for instance, eight men are required, one for each note. Mr. John Parrott, who for many years made possible the San Francisco symphony concerts, himself a thorough music student, once told me that to him the most remarkable feature of the Paris Exhibition of 1889 was a performance of the *William Tell* overture by the band of Russian Horns. The terrible difficulty of this feat may be realized if two students will try to produce a trill on the Piano, one playing the lower, the other taking the upper note. Then compare that achievement with the passage referred to. (No. 13.)



When one thinks of two pairs of alternate men executing trills in double sixths, and that thirteen men are required to produce a chromatic scale, it is obvious that the executants must be very musical and the drillmaster a type of that despotism long dominant in Russia.

Sackbuts and Trombones

Here again is an instrument which like the Shawm is rarely mentioned except in the Old Testament and like many words of vague or inaccessible meaning the translators of the King James version employed the word Sackbut as the nearest approach to the Hebrew.

As remarked in a preceding paragraph, the art of music, while under obligations to the Orient for the types of the majority of instruments which were later so wonderfully developed, is indebted to European builders for the development of a homogeneous bass in the various groups or consorts. As in the case of the Shawms and Recorders, the players of brass instruments succeeded in extending the range of their groups by means of a large Trumpet, called by the Italians Trombone (the augmentation of *Tromba* or *Tromp*) which was supplied with a slide enabling the player to vary the pitch at will, as he shortened or lengthened the tube.* The Spanish, noticing this

*This method of tone production is bewildering to the uninformed. An Oriental guest at the Paris opera gazing long at the trombonists, remarked that he "was amazed to see a Christian swallow so much brass."

peculiar motion, called the instrument a *Sacabuch* (a kind of pump), modified in England to Sackbut.

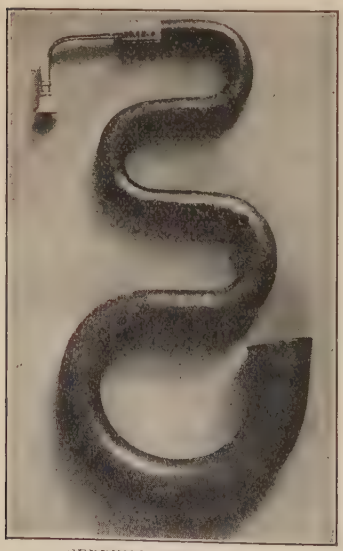
But in spite of this homely name, which appeared as early as the fourteenth century, it was greatly valued because of its perfect simplicity combined with the capacity of producing two and a half octaves of chromatic scale, every tone of which was of excellent quality. In fact, the Trombone (the name by which it was known in England from 1783 on) had the peculiar advantage of furnishing a range more comprehensive than any of the high-pitch brass, which instruments for another fifty years were meagre in tone variety and clumsy to manipulate. The Trumpets and Horns preserved their medieval qualities until 1831.

The efforts to extend the bass of the brass had been crowned with such success that it surpassed in variety and richness the brass in the upper registers, as above noted. To balance this, experiments were made with the latter. High Trombones were tried, but their tone was not so satisfactory, so they were by degrees abandoned, although in England a Slide-trumpet was long popular.

The Zincke and Serpent

Among the trials to obtain a soprano with a complete scale to balance the Trombones, the *Zincke* or *Cornetto* was produced and much used in the wind

bands of the fourteenth and fifteenth centuries. It was made of wood, covered with leather. The tone was produced with a cup mouthpiece like that of a Trumpet and was provided with holes enabling it to produce a chromatic scale of more than two octaves. Inasmuch as its powerful tone blended well with that of the Trombones, we can imagine how delighted were the composers of that day, thus to possess the equivalent of a complete brass group with a compass of four octaves.



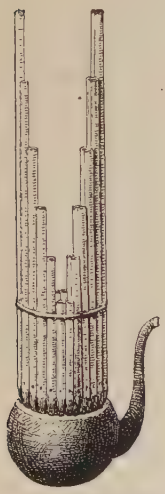
SERPENT, 18th century
(*Height* 33½ *in.*)
(*Mason Collection*)

One sees mention of the Zincke in the Bach scores here and there. Gluck was the last great composer to employ it, but it fell into disuse, doubtless owing to the severe strain involved on the lungs of the player. Of the same family is the Serpent, a bass instrument that owing to the length of tube required to give the low tones, had to be doubled back and forth like a Serpent, hence the name. This weird and unwieldy member of the Zincke family lingered until the mid-

dle of the nineteenth century but is now obsolete,* its place being taken by the Ophicleide which has also fallen into disuse.

The Chêng

When Edward MacDowell went to Columbia University to found the Music Department, he invited ten of us to give a series of lectures on topics relative to the evolution of music. Probably the most picturesque was that of Dr. William Adams Brown, who exhibited and performed upon some of the rarer instruments in the remarkable collection donated by his mother, Mrs. Crosby Brown, to the Metropolitan Museum. Among them was a curiosity from China known as the *Chêng* or *Shêng* (pronounced *shung*), which consists of a group of bamboo pipes bound around a central one and fastened in a gourd which amplifies the sound and through the mouthpiece the performer *sucks in* the air (the reverse of blowing). The sound results from the vibrations of free reeds, one of which is in each pipe. The Chêng, which is practically a set of Pandian Pipes *plus reeds*, is used



CHINESE CHÊNG

*The Serpent was employed by Rossini and Verdi, by Mendelssohn in *St. Paul*, and by Wagner in *Rienzi*.

only on important occasions and the players, whose lungs are put to such a peculiar strain, often become weakened in consequence. In the latter part of the eighteenth century, an instrument of this kind was on exhibition in St. Petersburg and attracted the attention of an organ builder who thought of applying the principle of the free reed (a reed that moves both ways—out and in) to the Organ. The ultimate result of this investigation was the invention of instruments like the Harmonium, Melodeon, Reed Organ, together with their humbler sisters, the Concertina, Accordion and Harmonica (Mouth-Organ). Few realize when attending services in a rural church or a prayer-meeting in a city chapel, where serious thoughts blend with the tones of the Reed Organ, how much of the mood of the moment they owe to their spiritually and culturally remote brethren of pagan China.

Questions for Review

1. What are the four principal groups of Wind-Instruments?
2. Mention a few of each group.
3. How are the tones of the Pandean Pipes, Flute, Whistle and Flageolet produced?
4. How can a scale be produced upon a single pipe?
5. How can the one octave of a pipe compass be extended?

6. Tell something of the use of the Flute in the religious ceremonies of the Ancient Aztecs.
7. Describe a typical instrument with reeds.
8. Tell something of the Shawm.
9. What was the *Bombard* or *Pommer*?
10. Mention some Oriental instruments akin to the Flute and Shawm.
11. Describe the Recorders.
12. What English authors mention the Recorder?
13. Give an idea of the method of grouping the instruments in the orchestra of the 15th Century.
14. What was the nature of the first Horns?
15. Give references to Trumpets and Horns in the Scriptures and other ancient writings.
16. Give the Natural Scale or Harmonic Series.
17. Give a series of tones possible to Horn and Trumpet with two or more typical motives.
18. Tell something of the Sackbut and Trombone and the origin of their names.
19. What was the Zincke?
20. Describe the Serpent.
21. Describe the Chinese Chêng and mention European instruments related to it.

References

Engel	Musical Instruments (London 1908).
Galpin	Old English Instruments of Music
Hamilton	Outlines of Music History, Chapter I.

Hipkins	Musical Instruments, historic, rare and unique.
Sachs	Real-lexicon der Musikinstrumente.
Stanford and Forsyth	History of Music, Chapters II-IV.
Stainer	The Music of the Bible.
Pratt	History of Music, Chapter V.
Brown Mrs. Crosby	Musical Instruments and their Homes.
Grove's Dictionary	*Articles*: Bagpipe, Bassoon, Boehm Flute, Horn, Oboe, Ophecleide, Serpent, Shawm, Trombone, Trumpet, Zincke.

ILLUSTRATIVE RECORDS

V—Victor; B—Brunswick; C—Columbia; E—Edison.

Music Mentioned in Chapter II

Chinese Flute, Wong seo V (50170).

Indian Flute, Lieurance—By the Waters of Minnetonka V.

Chapter III

PRIMITIVE, ORIENTAL AND MEDIEVAL STRING INSTRUMENTS

"Orpheus' Lute was strung with the Poets' sinews."
—*Shakespeare.*

IN the days of prehistoric man (how much "pre" and to what extent "historic" who shall say?) it was observed that when an arrow was shot, the twanging of the bow emitted a *definite sound.* The effect upon the ear was pleasing, and in the course of prehistory, the idea of combining two and more strings to be twanged, not for war, but for peaceful pleasure, gave rise to the Harp, Lyre and their numerous offspring.

EGYPTIAN HARP

In the sculptures and wall paintings of ancient Egypt we see representations of Harps of such size and provided with such a number of strings that one is led to infer they commanded a goodly tonal range

and produced tones of considerable depth—possibly the lower tones on the bass clef.*

TABLE OF STRINGED INSTRUMENTS

A. Strings plucked	(*a*) With the hand	Harp	Africa Asia and Europe
	(*b*) With a plectrum held in the hand	Lyre (Greece, etc.)	
		Crote (Northern Europe)	
		Lute (Arabia & Europe)	
		Mandolin (Italy)	
		Sam Yin (China)	
		Vina (India)	
		Psalter (Arabia)	
	(*c*) With plectrums controlled by a keyboard	Spinet (Europe)	
		Harpsichord	
B. Strings played with a bow		Monochord (Egypt, Greece, etc.)	
		Rebec (Rebab) (Arabia)	
		Yee Yin (China)	
		Crwth (Crowd or Crote) (Britain)	
		Viol group (Europe)	
		Violin group (Europe)	
C. Strings struck	(*a*) With hammers held in the hand	Qanon (Arabia, Persia)	
		Cembalo, (Cymbalona) (Hungary)	
		Yong Kim (China)	
		Dulcimer (Europe)	
	(*b*) With hammers controlled by a keyboard.	Clavichord (Europe)	
		Pianoforte (Europe)	

It is unnecessary to dilate on the numerous shapes

*While this inference cannot be proven it is different with wind instruments; thus, a Flute found in the tomb of the Theban Kings yielded the tones of an almost complete chromatic scale, while an Aztec Flute in the British Museum gave the series of the pentatonic scale used by the ancient Mexicans, a fact which may seem to confirm the opinions of those who believe in the Mongolian origin of this unfortunate people.

ENGLISH HARP, 11th Century

and sizes assumed by the Harp during the past 6000 or more years. A glance at the illustrations in any History of Music, or a visit to a museum will show that the ancient Harp lacked a front pillar, while that valuable feature which adds materially to its strength of body and tone is to be found in all modern specimens. It will be observed that a Harp built prior to the beginning of the last century could produce little beside the diatonic scale, while the invention of the *double action* by Sebastian Erard in 1801 renders possible the performance of a passage in any given key.

IRISH HARP
(Early 13th Century)

Its history is more extensive, possibly, than any

other instrument. It is the first one mentioned in the Scriptures and one of the last. Its tones awaken thoughts of the poetic, heroic and supernatural. Its association with the rites of numerous religions, expressing those reachings out of Man after the Infinite, have imparted to it a celestial character difficult to obliterate even when surrounded by the noisy implements of the modern orchestra.*

The Lyre

The ancient Lyre (Greek *Lyra*) consisted of a hollow wooden body or resonator, from which arose two arms (sometimes also hollow) curved outward and forward.

A crossbar or yoke connected these arms. Another crossbar was on the sound-chest which thus received the vibrations of the strings which were stretched between the two crossbars. The Lyre had fewer strings than the Harp, numbering at different periods three, four, seven and eleven. While the Harp was plucked with the fingers, the Lyre was picked with a *plectrum*.† It superseded the Aulos because it permitted

*Those who attended the concert of the National Association of Harpists at Indianapolis in May, 1924, will not forget the impression created when the curtain rose, revealing tier after tier of the eighty-four harpists in white with their gilded Harps. It was a little difficult to breathe, and the heart throbs of many were quickened.

†Performers on instruments whose tones were created by plucking the strings and thus throwing them into vibration often found it painful when the strings were of metal or were strung at a high tension. To obviate this evil a bit of bone or metal was substituted, known as a Plectrum (from Gr. *Plektron*).

a singer to accompany himself, a feat which of course no Aulos player could accomplish, while as mentioned in a preceding paragraph the blowing upon the wind instruments so distorted the features that the performances upon all such were confined to slaves. Songs accompanied by the Lyre were called *lyric*, a term which has been perpetuated in the European languages to this day.

GREEK CITHARA

GREEK LYRE
(*Each of seven strings*)

A larger form of Lyre, the Cithera (Gr. *Kithara*) was also much in vogue. Indeed these two names were so frequently used indiscriminately as to puzzle the authorities. Nevertheless, they agree that in some form or other the Lyre exerted its influence on the peoples of Northern and Western Europe. As it is known, however, that the inhabitants of the British

Isles possessed a lyre-like instrument before the Christian era, some believed that they derived it from the plains of Western Asia, the same source from whence the Greeks derived theirs. Be this as it may, the Crot or Croit of the Kelts, called on the continent the Hrotta, Rotta or Rotte, was employed in its lyre-like form until the Welsh developed it into the Crwth and played it with a bow, as will be seen presently.

Music and Mathematics

Attention was called in a previous paragraph (p. 31) to the progress implied when Man discovered that it was not necessary to construct an entire set of pipes to obtain all the notes of a scale: for one pipe with a series of holes could with greater ease and certainty produce the same tones. As in the case of wind instruments, so also a similar treatment of strings proved successful. We accordingly find that as early as 3000 B. C. the principle of dividing a string into different lengths to obtain as many sounds was applied by musicians. The mathematicians Pythagoras and Euclid (in the sixth and fourth centuries B. C.) employed an instrument known as the *Monochord*, consisting of a long box of thin wood with a firm bridge at either end, over which was stretched a wire or catgut string. A movable bridge being placed on the box rendered it possible to meas-

ure accurately the lengths of the string required to produce certain given sounds. The mathematicians not only in Egypt and Greece but also in Arabia, China and other ancient countries, early observed that if a string of a given length produced a certain tone (the fundamental) a string of half that length will yield a tone an octave higher, while a string one-third the original length will produce a twelfth above the fundamental.* In this co-operation of the mathematicians with the practical musicians the science of acoustics was developed and an intellectual quality, so essential to all worthy phases of Art, was imparted even to so preëminently an emotional expression as Music.

It was the discovery of this principle that led to the construction of all those instruments where the tones are directly formed or modified by the performer himself and are not, as it were, "built into" the instrument as is the case with the Harp, Lyre, Dulcimer or Pianoforte.

The Relatives of the Lute

Those who have listened to the natives of Arabia strumming on their stringed instruments may find it difficult to feel much enthusiasm for their art. However, lest we think too lightly of their music, let us

*See Gehrkens' *Fundamentals of Music*, Chap. VII.

take to heart the import of the ancient Arab proverb, "He who hunts not, who loves not, who trembles not with the tones of music . . . . he is no man!" The angel Israfel "whose heart-strings are a Lute" is a peculiarly Arabian conception. But we know that the children of Ishmael were not merely men of fiery temperament, for there were among them many able mathematicians and that the essential combination of great emotional with high intellectual powers finds expression in the claim of the Arabs that Pythagoras was the inventor of the Lute, "the crown of all instruments." The name passed through a curious series of metamorphoses: Arabian *Al'oud* ("the wood," especially the aloes wood of which it was constructed) then Portuguese *Alaud*, Spanish *Laut*, German *Laute*, French *Luth*, English *Lute*. This series of changes of the name may possibly indicate its gradual progress northwards through Europe.

But there were many kindred instruments in use during the Middle Ages, some with names variously spelled, such as the Gittern, Getern, Gyttren, Gythorn and later a Cithren or Cittern, then the Sytholle, Sitole, Cythol or Cytol. A fine representation of a Gittern is seen in the hands of an angel carved in the choir-arches at Lincoln Cathedral. Other angels hold the Citole. The Gittern had a bridge as in our Violin, while in the Citole the strings ran straight across. These curious names were often confused

CITOLE CITOLE GITTERN
(From the Choir stalls of Lincoln Cathedral, 1350-1380)

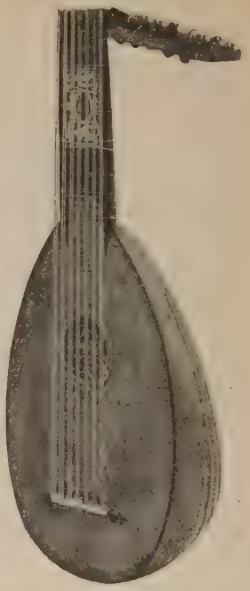
and the archeologist in reading descriptions of the music of those days is sometimes at a loss to learn exactly what was meant by this or that word.

The Lute

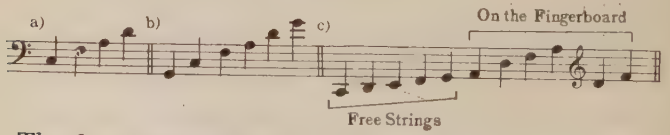
The Lute is a very graceful instrument consisting of a large pear-shaped body with a long neck and a finger-board provided with *frets.** The pear-like form of the Lute, Mandolin and kindred types is a survival of those Oriental resonators or sound amplifiers made of gourds covered with skin. The frets, metal transverse bars like those in our modern Guitars, were stationary, but served the purpose of dividing the strings into various lengths as effectively as did the movable bridge of the Monochord. They are virtually guides to the fingers in forming the

*The term fret is derived from the old French *ferretté* "banded with iron or other metal."

various tones and their value may be easily tested by the beginner who tries producing a scale on the smooth undivided finger-board of a Violin and then attempts the same passage on a Guitar whose frets will greatly simplify the experiment.

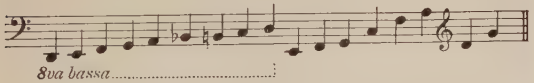


ITALIAN LUTE
(17th century)
(*Boston Museum of Fine Art*)

The Lute which flourished in the sixteenth and seventeenth centuries, was originally provided with four strings (as at *a*) then two others were added (usually tuned as at *b*). Then as the instrument grew in popularity still others were added with various tunings. Finally the number and complexity of strings and tunings were so great that they helped bring about its downfall (*c*).

The free strings were such as were not governed by frets and consequently could only give the tones indicated.

A Lute Consort

As the demand for a wider range of tones including

a worthy bass resulted in complete sets of Recorders and Shawms, while Sackbuts were made to supplement the Trumpets and Horns, so too were Lutes devised that gave the lower registers of the human voice and even lower yet as the Lute family became more elaborate. The larger types were known as Archlute, Chitarrone (or large Chitar) and Bass Theorbo. The lowest compass given by Grove is startling for it descends below the *E* of our double basses.

It was my good fortune some years ago to be present at one of the entertainments given by the Salmagundi Club of New York, when a Lute and Bandora Club rendered a number of characteristic pieces that carried one back to the Venice of Titian and Tintoretto. So picturesque is the quality of these aristocratic instruments, that in this day of striving for novel tone color and quaint effects their revival

CHITARRONE
Bass Archlute
(17th Century)

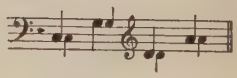
would be welcome.* Royal amateurs such as Henry VIII and his children as well as men of note like Martin Luther were performers on the Lute while J. S. Bach, wrote several pieces for it, among them

the *Fugue in G-minor*, later rewritten for violin solo in *D-minor* and then again recast for the organ.

Mandoline and Mandola

The only instruments in use at the present day that are akin to the Lute are the Mandoline and its tenor brother the Mandola or Mandora. The latter is extremely rare. They may be regarded as first cousins to the Lute for they too have the pear-shaped back in common and are played with a plectrum or pick of ivory, horn or tortoise shell. But unlike the Lute they possess four unison pairs of wire strings, tuned respectively like the Violin and Viola.

MANDOLINE



MANDOLA

The tone of the Mandoline is fine and wiry but singularly penetrating, so that its presence in the orchestra even in a *forte* passage is quite obvious.

*So obsolete has the Lute become that although it is a feature of the *Meistersinger* score, the passages demanding it are played on a dismantled harp.

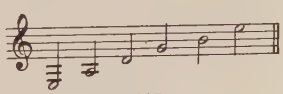
Mozart gives it to Don Juan in the celebrated *Serenade* in the opera of that name, while Verdi has employed it with beautiful results in *Otello.* In the *Feast of Lanterns* from my *Aladdin Suite* I have combined Mandoline and Harp to suggest the Chinese Yong Kim in a treatment of the theme given in No. 14.

In spite of the spirit of levity usually associated with this instrument, I believe it capable of truly serious treatment. In the orchestral version of my setting of Poe's *Israfel* I have employed the tremolando of the low strings, as I fancy they faintly resemble the "wires" of which the poet writes.

The low register of the Mandola possesses a rich warmth which might prove of value to the composer.

The Guitar

Like the Scotsman who refers to another as "a cousin only seven times removed" the familiar Guitar may claim a certain relationship to the Lute. True, its back is flat, but it has frets and is plucked, although with fingers and thumb instead of a plectrum. Again its tuning is somewhat lute-like—a series of fourths with one-third between. Its tones sound an octave lower than written (16 foot pitch).



GUITAR

Popular in Spain and Italy, it was formerly much

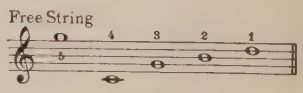
in use in this country* to accompany vocal numbers, but during the last few decades has been outclassed by the Piano, as a household music provider.

The Banjo

Another humbler and still more remote relative of the Lute is the Banjo, so dear to the colored people in the Sunny South.

Although it was generally considered to be an invention of this very musical people, authorities are of the opinion that it is descended from the Senegambian *Bania*, or that the name is derived from Bandora.

The Banjo has a long neck with a body like a drumhead of parchment, but with no back or soundingboard consequently the tone produced is of a humorous character, sometimes almost percussive. It has no frets, and the number of strings and the methods of tuning vary. The most general tuning of the simple five string Banjo is as follows:



BANJO

Curiously enough the free string is the highest of all instead of being in the lowest register as in all of the Lute tribe.

*Dr. Burney, the English musical author relates an amusing story showing the absurd influence of temporary fits of fashion. He writes that the later 18th century in England witnessed such a craze for the Guitar that even ladies of fashion sold their harpsichords at a third of their value. To save his business a Harpsichord maker hit upon the device of presenting cheap Guitars to culinary maids and street ballad-singers "which soon made the ladies ashamed of their frivolous and vulgar taste, and return to the Harpsichord."

Outside of Negro Minstrelsy it is not used with the orchestra. In *The Girl of the Golden West* Puccini forces the Harp to suggest the Banjo in certain scenes.

Of late, performers have developed the resources of the improved instrument to such an extent that they execute bravura passages from Liszt's *Hungarian Rhapsodies* and the like.

The Sam Yin and Vina

The peoples of the Orient with their traditions extending backwards into the depths of time often present conflicting claims regarding the age of an invention. Two types of Lute are to be found in various parts of Asia, which may have been indigenous to their respective homes or they may have been suggested by foreigners and then modified and adopted. Perhaps the most striking illustrations of this principle are the Sam Yin of the Chinese and the Vina from India. As the former is the more primitive it is first mentioned. The Sam Yin is an instrument with three strings, tuned as follows:

It will be seen that they give the fundamental, fifth and octave of the key of *G* (see *a*), which shows that their music has a solid basis in common with ours and in the melodies played upon the Sam Yin certain

phrases in the tonic are repeated in the dominant. The only harmonies they employ result from placing the finger straight across the upper two strings, giving always parallel fourths (see *b*). A complete triad they never use. Indeed in all Oriental countries any harmonies such as we enjoy are regarded as an intrusion.

VINA from INDIA

The *Vina* (or *Veena*) considered the most ancient instrument possessed by the Hindus, consists of a long hollow wooden tube supported on two empty gourds which add to its resonance. Beneath its seven strings are movable frets that can be arranged to fit the "mode" of the music. When the strings lying above them are pressed, they can give a series of quàrter-tones. This would seem to be difficult for us to apprehend, accustomed as we are to whole-steps and half-steps. But on carefully listening to the recital in New York of a certain Hindu artist, Mr. Khan, who played and sang these quarter-steps with great clarity, they were indeed readily distinguished, but the long winding melodies were difficult to follow. However,

the Hindus also employ seven-tone scales, similar to ours and even the pentatonic, or five-tone, like that of the Chinese. One of these five-tone melodies was brought to our country many years ago by a missionary and is sung to the familiar words, *There is a Happy Land,* which can be played on the black keys of the Piano.

Psaltery and Dulcimer

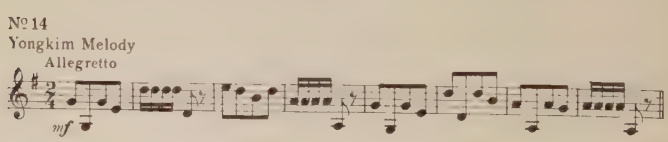
In the Mohammedan countries during the early Middle Ages, there existed two harp-like instruments similar in appearance but played in quite different ways. One was called by the Arabs *Qanon* (Gr. *Psalterion,* Old. Eng. *Sautry,* Ger. *Psalter*) and the tones were produced by plucking the strings with plectrums. Its sister, the *Santir,* was played with two light wooden hammers. Both types became known throughout Europe where the latter received the name of *Cembalo* in Italy (from its brilliant brazen tone). The Hungarians at the present day employ a similar type with a similar name, *Zimbalon.* In Germany the mode of performance gave rise to the name *Hackbrett* (chopping-board) while its sweet tones led to its being christened *Dulcimer* in England.

The Psaltery is so long obsolete that specimens are rare. The Dulcimer is still to be seen in museums but to obtain an idea of its music, we must refer to those types still employed by the Chinese and the

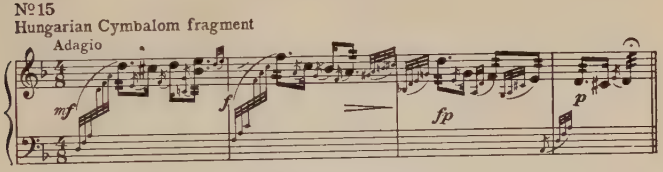
Hungarian Gypsies, namely the Yong Kim and the Cymbalom. The music performed on the former is

PSALTERY (15th century) DULCIMER

The illustration showing the two instruments and modes of playing are from fifteenth century carvings in the Manchester Cathedral.

characterized by frequent octave jumps* and short tremolos that result from the rebounding of the little elastic hammers. Rarely are two tones sounded simultaneously. (See No. 14).

The Hungarians, although likewise limited to two hammers in playing the Cymbalom, obtain far more florid effects than are possible upon the Yong Kim.

*The Chinese musician who played the above theme was very anxious for me to realize the relation of various lower tones to their upper octaves. Playing the lower *G* then the upper one, he remarked "Allee same," thus proving (what some are inclined to deny) that the Chinese do possess a sense of the fundamentals of music. (See page 21.)

Arpeggios, grace notes, and syncopated rhythms are produced with much dynamic variety. (See No. 15).

The Arabian instruments the Qanon and Santir after being much modified in different lands, were each of them provided with keyboards, a valuable feature borrowed from the European Organ.

The Psaltery with keys to govern the plectrums became the *Spinet* (from Lat. *spina*—a thorn) while the Germans called it a *Kielflügel* or *quill-clavier*. This system of tone production was also used in the Virginal and Harpsichord.

The keyed Dulcimer or Clavi-Cembalum became the ancestor of the Clavichord and Pianoforte. This group will be more fully discussed in Chapter V and is mentioned here merely to complete the historical outline of musical instruments.

The Value of the Bow

The chief defect in all stringed instruments, plucked or struck, is the evanescent character of their tones, for no matter how lovely their quality they die away soon after their birth. In order to remedy this defect, some unknown genius (presumably a Persian

or Hindu) resorted to *friction*. This friction was produced by rubbing a bow string with hair across one or more strings, generating a steady, continuous tone, that could be increased or lessened according to the amount of pressure brought to bear on the bow. Thus did the implement of the hunt, associated with Apollo and Diana, which had led to the invention of Lyre and Harp, aid the Art of Music a second time by lending its service in evoking tones of greater intensity and expressiveness.

Primitive Bowed Instruments

The Monochord described above when played with a bow was doubtless the first move toward the invention of the Viol. Although the Monochord is more frequently mentioned in connection with acoustics, still it is worth noting that the first Lyre or Rebec introduced in Europe (as early as the eighth century) had but *one* string.

We find in China two specimens of bowed instruments, each with two strings. The *Yee Yin* or *Ur Heen* is the smaller and is tuned in *g* and *d*. Its strings run into a little block of wood instead of a sounding-box. The bow which is lodged *between* the strings can never leave them, and produces a tone plaintive and shrill in the upper register and slightly absurd in the lower. The *Voo Kam* is a larger specimen and has the advantage of a fairly effective resonator and a free bow.

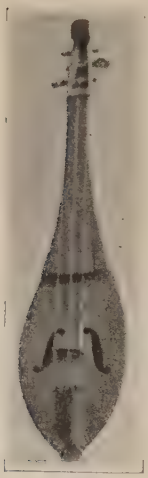
If a bow be applied to a group of three or more strings lying parallel, they will produce a jumble of tones unless tuned to a given chord. For this reason the high number of strings in the later Lutes would be a disadvantage, so that whether we see the bowed Monochord, the Yee Yin and Voo Kam of the Chinese, the kindred two-stringed Ravanastron or the three-stringed Serinda of the Hindus, there is an obvious effort to so place the strings that the bow can reach one at a time. For this reason the bridge over which they are strung is always convex in shape.

The Rebec

Whether in imitation of instruments imported from the East or the result of individual experiment, the bow was applied to the Crwth, Crowd or Rote of the British Isles as early as the eleventh century. But it must be remembered that, while a greater and more sustained tone was obtained by stroking with the bow than by plucking the strings, these lyre-like instruments could yield but one tone to a string. Hence the Arabian Rebec was a great improvement, for it not only demanded a bow but it had a fingerboard permitting a variation of pitch on each of its three strings. Its shrill tone enabled it to hold its own in the medieval orchestras. Henry VIII, the great royal amateur, employed three in his band.

The Chest of Viols

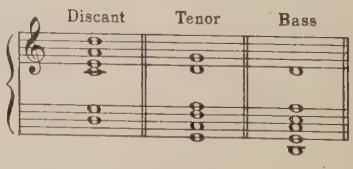
But the Rebec was doomed to be superseded by the Viol, a six-stringed bowed instrument with frets like



REBEC
(18th cent.)

CRWTH (Wales)
(*Height* 22¾ *in.*)

those of the Lute. It was used to accompany singing and like other types of European device or improvement was made in various sizes so that we read of sets or "Chests of Viols."

The three principle sizes were: Discant (or Treble), Tenor and Bass, the last tuned an octave below the Discant.

Questions for Review

1. State the three methods of producing tones upon stringed instruments.
2. Tell what you can of the Harp and quote allusions to it in literature.
3. What are the chief improvements made in the modern Harp and what are their advantages?
4. Mention certain instruments played with a plectrum or pick.
5. Tell something of the Lyre and its use.
6. What was the Monochord?
7. Describe the Lute and mention a few references to this instrument in literature.
8. Mention certain instruments akin to the Lute.
9. Describe the Mandolin.
10. Describe the Guitar.
11. Describe the Banjo.
12. Describe the Sam Yin.
13. Describe the Vina.
14. Describe and compare the Psaltery with the Dulcimer.
15. To what instruments with keyboards were they related?
16. What is the advantage of using a bow upon a stringed instrument?
17. Mention a few bowed instruments.
18. Tell something of the Crwth, or Crowd.
19. What was the Rebec?
20. Describe the Viol.

References

Engel	Musical Instruments (London 1908).
Galpin	Old English Instruments of Music, Chapters VIII, IX.
Sachs	Real-lexicon der Musikinstrumente.
Hipkins	Musical Instruments, historic, rare and unique.
Wallenschek	Primitive Music.
Stanford and Forsyth	History of Music, Chapters VII, IX.
Gevaert	Histoire de la musique dans l'Antiquite.
Grove's Dictionary	*Articles*: Banjo, Chitaronne, Crwth, Guitar, Harp, Lute, Lyre, Mandolin, Rebec, Theorbo, Viol.

ILLUSTRATIVE RECORDS

V—Victor; B—Brunswick; C—Columbia; E—Edison.

Music Mentioned in Chapter III

Banjo, Dixie V (17583).
Banjo, (Chinese) V (42329).
Banjo, Moret—Poppies E.
Dulcimer, Brahms—Hungarian Dance, No. 5 V.
Guitar, Rapsodia Portugueza V.
Guitar, Hilo March E.
Koto, (Japanese) V (11170).
Lute, de la Halle—Robins m'aime V (17760).
Lute, (Arabian) Takasim Nahawand V (73466).
Bass Lute, Vassourlima V (69232).
Mandolin, Valverde—Clavelitos V (544).
Mandolin, Scallari—Hungarian Serenade E.
Samisen, (Japanese) Lion at Play V (11260).

Chapter IV

THE ORGAN

"The storied windows richly dight,
Casting a dim religious light.
There let the pealing organ blow
To the full-voiced choir below!"

—*Milton.*

"The Organ is in truth the most daring, the most magnificent of all instruments invented by human genius. . . . . Surely it is in some sort a pedestal on which the soul poises for a flight forth into space . . . . to cross the Infinite that separates heaven from earth."—*Balzac.*

So completely has the Organ been identified with religious services, so interwoven are its strains with sacred, historical and personal memories, so indissolubly united with the saddest, as well as the happiest events of life, the accompaniment of deepest despondency and the greatest spiritual exaltation, that the thought of employing this noble servant of the church for the production of operatic or even orchestral transcriptions is distasteful to many. Indeed these spiritual associations lead some to regard the

building of municipal and extra-ecclesiastical organs as a secularization of the most majestic of all tone-producing mediums.

But associations are sometimes misleading and engender false impressions concerning a given object. It was this very element of association that was responsible for the long delayed introduction of the Organ in the Christian Church, for we are told that its employment in connection with the gladiatorial combats and the licentious orgies of pagan Rome engendered such an abhorrence in the minds of the early Christians, that not until the fifth or sixth century did it become a factor in divine worship.

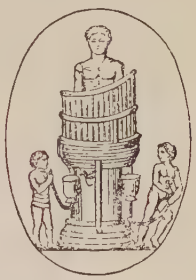
According to St. Augustine (354-430 A. D.), the term Organ was applied to all instruments "on which the musician performs a melody" and was "not confined to those of large dimensions in which the air is furnished by bellows," thus explaining how Jubal is mentioned in Genesis IV: 21 as "the father of all such as handle the Harp and Organ." But the first Organ to merit the name as we now use it was that of Ctesibius of Alexandria (circa 200 B. C.) who, after the manner of inventors, incorporated in his instrument all the features of importance in similar devices. The ultimate germ from which our modern Pipe Organ has developed was doubtless the Pandean Pipe or Syrinx.* The first step in advance was taken

*See p. 30.

when an effort was made to provide a supply of wind independent of the performer's own lungs.

The cut taken from an obelisk erected in Constantinople by Theodosius the Great (A. D. 346-395) shows at the left of the small Organ with its two performers, the bellows upon which the treaders who give it pressure are standing. Another way of supplying wind is shown in the other primitive Organ, the wind for which was supplied by two attendants who alternately blew with their mouths into pliable pipes.

HYDRAULUS
1st century



PNEUMATIC ORGAN—4th century

The Carthage Organ

Frequent allusions to the Water Organ or *Hydraulus* (literally *Water-Aulos*) were made by Cicero, Pliny and other writers. But concerning its real nature there was for many centuries much doubt, some

authorities believing that the water ran through the pipes producing the tone. Finally in 1885, among the ruins of an ancient temple at Carthage, there was unearthed a model of a typical Water Organ.

HYDRAULIC ORGAN
(Carthage cir. 150 A. D.)

A working model of this archeological treasure was prepared by the English authority, Rev. F. W. Galpin, who proved that the water did not enter the pipes, but was pumped up into a metal retainer and merely served to regulate the pressure of air in the wind chest, thus ensuring a steady, clear tone. This Water Organ* possessed nineteen keys, each about eight inches in length and two in width, arranged according to the six Greek scales and had metal springs for bringing the keys back to their normal position when the fingers were lifted.

The Organ Christianized

After the Organ had received ecclesiastical sanction it made its way through Greece, Italy and Spain

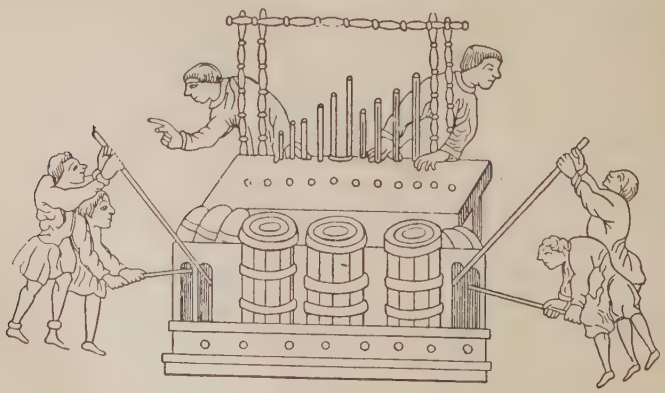
*Notice its similarity to the Roman Hydraulus shown on the preceding page.

to Northern Europe. In the meantime instruments of one type or another were made and employed in such a manner as to exert a pronounced influence upon the progress of the art of Music itself. It was no less a personage than Charlemagne who introduced the first Organ in Germany, constructed at Aix la Chapelle about 811 A. D. after the model of the one in Compeigne that had been presented to his father, King Pepin, a few years previous, by the Greek Emperor Constantine Copronymus.

The visitor to Winchester Cathedral who is interested in historical relics should not fail to descend into the crypt, where he will be shown certain columns and other fragments of the ancient Saxon Cathedral, the forerunner of the present one, and whose rafters once rang with the tones of an epoch-making Organ. This instrument, erected in the tenth century, produced a remarkable impression. It possessed 400 pipes and a contemporary writer informs us that it had "twice six bellows above ranged in a row and fourteen below," which indicates that there were two series of pipes or an arrangement that would correspond to two manuals. These bellows were worked "by seventy strong men" who "supplied an immense quantity of wind." Allusion is made to the "seven differences of joyous sounds adding the lyric semitone," which has been interpreted to imply the diatonic scale with a $B\flat$ as well as $B\natural$ for the purpose of

modulation, so that a passage in *C-major* could also be sung or played in *F*.

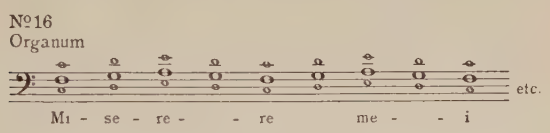
As there were no keys at this period, the wind being admitted to the pipes by means of "slides" which alternately covered and exposed the underside of the holes leading up to its pipes, it was impossible for one person to produce more than one or at most two tones at a time. This formidable Organ required three performers. The slides were lettered according to the tones of the scale, and each octave was termed an "alphabet." But in spite of the 400 pipes there could not have been more than two or three octaves, as each slider opened ten pipes which gave such a powerful tone "that everyone stopped with his hand his gaping ears," being unable "to bear the sound," which must have resembled that of the Calliopes which accompany our circus parades. The picture of an Organ taken from an eleventh century



ORGAN OF THE 11th CENTURY

Psalter shows two organists and four hard working bellows men, though the pipes are but ten in number.

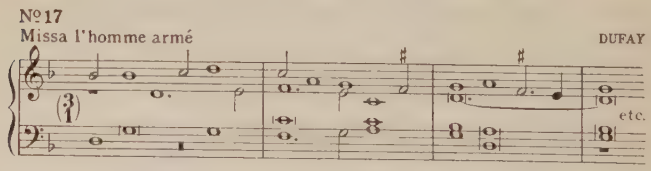
It has been suggested that the three performers on this formidable Winchester Organ may have played those curious progressions known as the "Organum" introduced about this time by Hucbald, and that this name was derived from the instrument. (See No. 16).



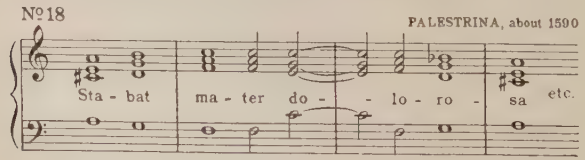
KEYS. The keys in use 500 years ago were three to five or more inches in width, one inch and a half thick and from eight inches to a yard or more in length, and it was necessary to depress them about a foot in order to produce a tone. The action was therefore slow and heavy and adapted only to music in *moderato* or *lento* movement. Although a keyboard was a feature of the Carthage Organ, this valuable factor was lost sight of during the Dark Ages, until it reappeared in the Organ of the Magdeburg Cathedral towards the end of the eleventh century, the first of which there is any authentic record.

THE COMPASS. The Compass of this Organ was sixteen notes, apparently about two and a half octaves or "alphabets," for the *B♭* was as yet the only accidental in use. In the seventh century Pope John VIII, having abolished congregational singing and

delegated this part of the service to canonicals, there would be no need of a greater range, for the Organ was used chiefly to double the vocal parts. Indeed, as late as the middle of the thirteenth century the compass did not exceed three octaves, usually from *G* to c^2 or from *C to* c^2, this representing the extent of men's voices plus the falsetto tones.

Chromatic Keys. Early in the fourteenth century *F*♯ was introduced in the Organ. An idea of the type of music rendered possible by the improvements in the Halberstadt Organ may be gained from the fragment of Dufay's "*Missa l'homme armé.*"

Note that Dufay (died 1432) was able to use an *F*♯ as well as a *B*♭.

Later on the keyboard was enriched by a *C*♯ and in the excerpt from Palestrina's *Stabat Mater* we note that *C*♯ as well as *B*♭ and *B*♮ were freely used and we feel the approach of modern harmony.*



*Notice that the early sixteenth century Organ pictured in the frontispiece has but three black keys.

By degrees *E♭* and finally *G♯* were added, rendering our chromatic scale complete. We who daily have the keyboard of Piano or Organ at our command can scarcely conceive the significance of this remarkable medieval achievement. It was in the fourteenth century that Organs were more generally adopted. The keys were made smaller and increased in number up to three octaves.

ORGAN—Early 14th century

KEYBOARDS. The principle of the *Keyboard* seems to have been revived about the twelfth century in small movable organs called *portatives* in contradistinction to those which were stationary, and therefore called *positive.*

PORTATIVE ORGAN

POSITIVE ORGAN
(Broad Keys without semitones)

In 1361 a large Organ was erected in Halberstadt

which had four keyboards, the upper clavier acting on all the pipes to each key, the middle one on a single row of pipes for a quieter effect. Their compass was about two octaves. The third keyboard of fourteen chromatic keys from B to A^1 was played by the hand or by the knee, and the fourth consisted of an octave of pedals.

STOPS. In the fifteenth century large iron levers were introduced to "stop" or cut off the wind supply from any given row of pipes, and this invention was the prototype of our modern "stop," which is drawn out to alter the tone-quality or volume by setting different groups of pipes in action.

PEDALS. Another fruitful innovation consisted in the introduction of keys for the feet. Although they were merely attached or "coupled" to the keys of the upper clavier or keyboard, the performer was enabled to hold down a tone in the bass with his foot while the upper parts were played with his hands. This invention gave rise to certain new terms. The keyboard played by the hands was called a manual (Lat. *manus*—a hand) to distinguish it from the pedals (from Lat. *pedis*—the foot) played by the feet. When the foot sustained a long note (or "point")* it was termed a "pedalpoint" or "organpoint," an expression still employed by theorists.

*See Gehrkens' *Fundamentals of Music*, p. 104.

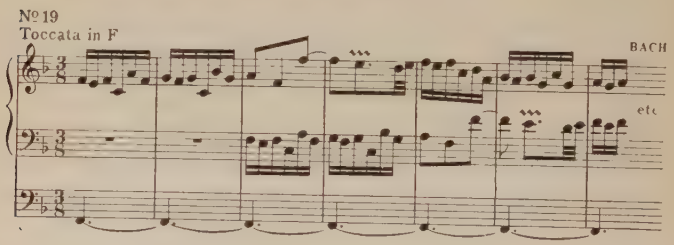
Independent Pedals

About 1468 the *Sebalduskirche* of Nuremberg was fitted out with a set of pedals with independent pedal-pipes, thus virtually increasing the compass of the instrument. Up to this time the size of the keys for the hand and those for the feet was the same. But with independent pedal-pipes it became possible to diminish the size of the keys in the manual, until about 1500 a large hand could span an octave and not long after they were reduced to the present proportions.

THIRTEENTH CENTURY ORGAN

The great Danish organist Buxtehude* was the first composer to write pieces for the Organ wholly dissociated from vocal text, thus creating for the first time "absolute" music. J. S. Bach when a youth walked fifty miles to Lübeck to hear him play and was so

*Dietrich Buxtehude was born in Helsingör, Denmark, 1637, and died in Lübeck, 1707. He was famed far and wide as an organist and composer.

stimulated that he developed still farther this principle of pure instrumental music, leaving the world a great literature as the result. An extract from one of his most characteristic works, the *Organ Toccata in F*, will give an idea of his style.

Note the canon in the octave between the soprano and tenor.

Pitch Designation

The lowest tone of the manual was "great *C*"* and was produced by a pipe eight feet in length and the entire series of pipes from that one up to the highest was known as a series or register of an "eight-foot pitch." The pedal pipes sounded an octave lower (the low *C* requiring a pipe sixteen feet in length), so this series was termed sixteen-foot pitch. Those registers of the manual, on the other hand, that sounded an octave higher than normal, or eight-foot pitch, were termed four-foot pitch, the registers sounding *two* octaves higher, two-foot pitch. The compass of the manual was gradually enlarged until in the

*See Gehrkens' *Fundamentals of Music*, p. 166.

eighteenth century Bach had four and one half octaves at his command, while the pedals had a range of two octaves and a fourth with all the chromatic notes, enabling him to produce passages like the following from the above quoted *Toccata in F*:

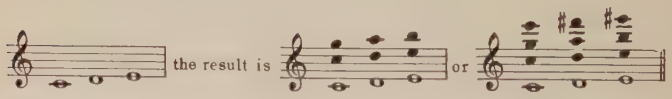
Singularly enough, pedals did not make their way into England till 1790, *three hundred years* after their appearance in Germany, otherwise Handel's organ music doubtless would have borne a stronger resemblance to that of J. S. Bach.

Wood Pipes

The early Organs, as already stated, had pipes of metal, but in the sixteenth century a variety of tone color was obtained by introducing pipes of wood. Experiments were made in constructing pipes of clay and paper and, taking a hint from the Chinese, of bamboo.* Another interesting and valuable revival of a lost art was the reintroduction of reeds, that is, metal pipes with tongues that vibrated after the manner of those in the Shawm or Oboe.

*Mr. Joseph Lasser, a Russian organist who has travelled in the Orient extensively, tells of a large Organ in Manila with bamboo pipes.

The Mixtures

Inasmuch as it was found that the pipes of the Organ generated few or no appreciable overtones that give vitality and character to the tones of the voice and instruments of the orchestra, efforts were made to supply this lack by artificial means, so groups of pipes were arranged to sound with the fundamental responding to every key pressed. The stops or registers of this class are known as *mixtures.* They have been differently combined, but usually consist of a fundamental, with octave, twelfth, and sometimes the third above the double octave (tierce) so that when we press the keys *c, d, e*:—

This effect is like some of the early organ music in the time of Hucbald. (See p. 89.)

The Swell

In 1712 the English organ builder Jordan invented another effect which proved very popular and consisted of a series of pipes placed in a box (swell-box) the front of which, like a Venetian Blind, could be opened or closed by a pressure of the foot, creating a *crescendo* and *diminuendo.* This was the first Swell Organ. Other experiments were made; possibly the most valuable was the *Progressionschweller*

of Abt Vogler* (1784-1796) which enabled one, by pressing a pedal, to draw out by degrees a few additional stops. This device was elaborated into the *Kollektionschweller* a century later, which introduces gradually all the stops of the Organ. In Organs of today this is a rocking lever played by the organist's foot and termed *Crescendo Pedal.*

The Coupler

In the seventeenth century a draw-stop was introduced in the Organ, called a *coupler,* by means of which the keys of a given manual were connected with those of another above or below. Thus the main keyboard or Great Organ could be connected with the Swell or Choir Organ, or the pedals could be coupled with Great, Swell or Choir Organ. The Combination-Stop, an elaboration of the preceding invention, is a draw-stop which enables the performer to simultaneously draw out several registers. A similar device regulated by the feet is termed a *Combination Pedal.*

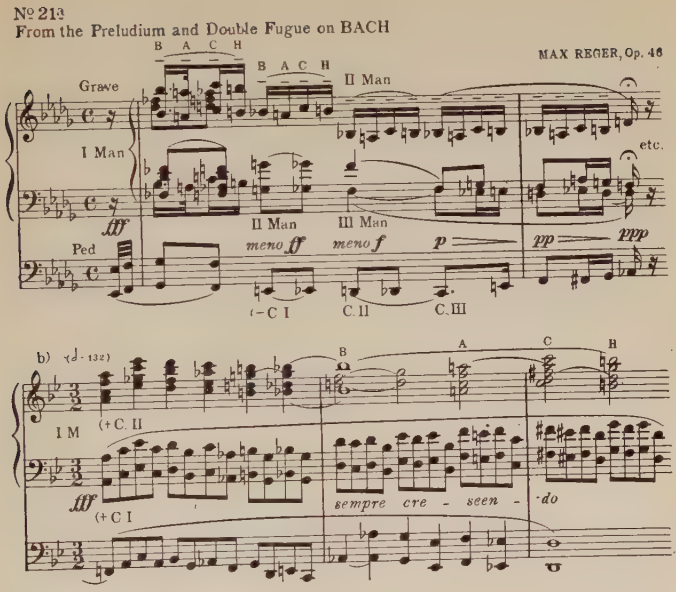
Pneumatic and Electro-Pneumatic Action

It is evident that the greater the number of pipes called into use, the greater will be the muscular force required to make them sound satisfactorily. So severe was the tension on some of the larger instruments that it was impossible for the performer to use

*Abt Vogler, chiefly known to us through Browning's poem of the name, was an able organist, inventor, composer and teacher. Among his pupils were Von Weber and Meyerbeer.

the full Organ with the desired effect. To obviate this difficulty the Pneumatic Action was devised. This consists of a counter air pressure which is brought to bear equalizing that required to depress the key. The result is that the manual of an Organ with all its registers open, is as easy to manipulate as the keyboard of the Pianoforte. Even this invaluable invention has been improved upon in the Electro-Pneumatic Action, first used in Philadelphia about 1880. With the application of electricity the complicated mechanism of the great modern Organ with its thousands of pipes is under perfect control, and the "King of Instruments" has entered upon a new and richer life.

Wind Supply

The ancient *Hydraulus* and those built in imitation of it were furnished with air by means of bellows trodden by a number of men, ranging from four to seventy according to the size of the Organ. Such bellows seem to have been in service from the fourth to the fourteenth centuries. Early in the nineteenth century pumping mechanisms were introduced to take the place of manual or pedal exertion and various devices were tried, such as clockwork, steam, water, hot air, gas engines, and finally electric motors which have proven to be the most effective.

The excerpts from Max Reger's *Preludium and Double Fugue on BACH* afford an illustration of the possibilities of the modern Organ; its facilities for rapid change of registration, etc., and transitions from *ppp* to *fff*. Observe the five-fold harmonizations of the motto initials at 21*a* and the advanced Organ technique demanded at *b* in the *fugue*, one of the greatest contrapuntal achievements of the age. It will be noticed that the rapid passages for the left hand and pedals would be impossible to execute on the old Organs with their stiff action.

Resumé

We have followed the development of the Organ from the grouping of a cluster of pipes or reeds, blown by the performer himself, to the mighty instrument with many series of pipes, supplied with wind by many bellows. We have seen how in the ancient European Organs, owing to the great size of the keys and the stiffness of the action, it required two or more players to force them down with their fists, but that, little by little, the keys were made smaller and smaller until it was possible for the performer to span an octave with one hand. The action too became more plastic so that with the aid of the pneumatic system (since replaced frequently by electric action) the organist can render upon the full Organ the most rapid passages with great facility.

It is possible therefore, to give a brief description of the Organ, as it has existed for the past century or more, and as the composers of organ music conceive it when penning their creations.

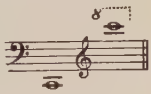
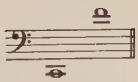
Modern Organs

A unique feature of the Organ is its extraordinary adaptability to the environment even under widely diverse conditions. Like Gothic architecture which lends its character to the modest porter's lodge as well as to the most magnificent cathedral, the Organ can be so devised as to suit the requirements of a simple

chapel or it can be expanded to such dimensions as to satisfy the demands of a great exposition building.

It is sometimes found in small churches in Europe with but one manual and no pedals, but in our country there are usually pedals to the extent of an octave and a fifth, with four to eight registers (sets of pipes) in the manual (*Great Organ*) of the smallest specimens.

The moment we have two manuals at our disposal a great advantage is obviously derived, as it is then possible to play a melody on one, while the accompaniment is played on the other, more softly, or in contrasting tone-color. This lends a variety impossible to acquire on a one-manual Organ.

In Organs planned for private residences or churches of moderate size the organ-builder of taste sees to it that the "voicing" of the various registers is homogeneous so that all blend well together and no one stop is unpleasantly prominent. Sometimes the builder is overruled by the church committee, who honestly wish the worth of their money in tone volume. Consequently certain pipes, usually the *Open Diapason,* are so adjusted as to do double duty and the blatant register drowns all the others. The average compass of the manual keyboard is:

while the pedal range is generally the same as in Bach's time:

Two Manual Organs are usually divided as fol-

lows: *Great Organ, Swell Organ,* and *Pedal Organ.*

Three Manual Organs: *Great, Swell, Choir,* and *Pedal.*

Four Manual Organs: *Great, Swell, Choir, Solo,* and *Pedal.*

In five Manual Organs the fifth is the *Echo* Organ, though this is usually played from the *Solo* manual or from the *Choir.* The pipes of this Organ are usually concealed high in the vaulted roof of the church where its delicate registers yield an ethereal effect like an echo, hence its name. The electric connection between the keyboard and the pipes makes this possible, and also the playing of Organs at opposite ends of a large church from a single console.* In concert halls the Organ console is detachable from its electric connection and can be moved out of sight when not in use.

A word should be said regarding the principal groups or tone families into which the various stops are divided. The four main divisions are 1. *Diapason,* or Organ foundation tone, 2. *Flute* tone, 3. *String* tone, and 4. *Reed* tone. In a properly constructed Organ, whether large or small, these different tone qualities are present and properly balanced.

*The combined keyboards, pedals, draw-stops, couplers, etc. by which the performer controls the entire organ mechanism is termed the *console.*

CONSOLE OF THE ORGAN IN THE LEGION OF HONOR TEMPLE
San Francisco, California
(*Courtesy, Skinner Organ Company, Boston*)

The manuals from top to bottom are *Solo, Swell, Great* and *Choir.* The *Echo* organ is played from the *Solo* and *Choir.*

The knobs of the draw-stops on the panels at the left are *Pedal, Swell* and *Echo;* and at the right *Choir, Great* and *Solo.*

The tilting-tablets above the manuals are the *Couplers.* The small pistons between the manuals are the *Combinations.* The toe-pistons at the right of the expression-shoes are *Pedal-combinations.* The five balanced expression-shoes or levers are, from left to right, *Great, Choir, Swell* and *Solo.* The fifth shoe is the *Crescendo Pedal* controlling the entire organ.

Of the 166 knobs, 98 are speaking stops, the others control the Harp, Chimes, Tremolos and other mechanicals.

In closing, attention should be called to the fact that, as in the case of all other creations of mortal man, the Organ has its positive and negative qual-

ities. The skilled organist with a typical instrument of the present day, has a greater variety of dynamic effects at his command than a performer on any other tone-producing medium. He can pass by degrees from *ppp* to *fff*, or he can make the transition *at once*. Inasmuch as the modern concert Organ is practically a combination of instruments, the player has a great number of tone colors with which to decorate the outlines of the musical composition he renders. Having, moreover, a keyboard for the feet, he can produce two more tones in the lower portion of the harmonic structure and by means of various couplers can add not only octave after octave above and below the tones represented by the keys pressed by his fingers, but by employing the "mixtures" he can throw into the sound-mass a great number of artificial overtones above each fundamental.

On the other hand there are certain limitations in respect to musical expressiveness which the greatest artists endeavor to conceal, some succeeding to such an extent that the existence of these disadvantages is overlooked or forgotten, thus giving that emphasis which the composer would demand from the Piano or orchestra. The very virtue of the evenly sustained tone which is possible to the Organ as upon no other instrument has its complementary difficulty, for this equable dynamic quality renders it impossible to accent the important notes in a phrase. To minimize this drawback, builders have, within the past few

decades, provided not only the Swell Organ proper, but the other manuals, Great, Choir, Solo and Echo, with swell-boxes so as to produce a *crescendo* and *diminuendo* of a sustained harmony altogether out of the question upon the Pianoforte and with a homogeneity of tone quality rarely heard in the orchestra.

ORGAN OF OLIVER HOLDEN (1765-1834), which he used in composing *Coronation* and other hymns. Now in Old State House, Boston.

Questions for Review

1. When and where was the first notable Organ invented?
2. Spell the name of the inventor.
3. What was the nature of the Water Organ?
4. When was the model of the Carthage Organ discovered?

5. Why did not the early Christians employ the instrument?
6. Who first introduced the Organ in Germany and where?
7. Where was the first notable English Church Organ and when built?
8. Give some details concerning this instrument.
9. How were the Organ tones controlled?
10. Tell something of the nature of the keys in the medieval organs.
11. What was the first accidental or chromatic key employed?
12. When was F♯ introduced?
13. Define *Portative* and *Positive* Organ.
14. Describe the chief differences between the early medieval organs and those of the present day.
15. Relate something of the history of the pedals.
16. What pedal compass did Bach employ?
17. When did pedals first appear in England?
18. Explain the expression 8 *foot* and 16 *foot* pitch.
19. What materials are chiefly used in the construction of Organ pipes?
20. What is the chief advantage to the performer of two or more manuals?
21. Give the names of the various manuals in the modern Organ.
22. Give other details concerning modern instruments—Couplers, Pneumatic Action, etc.

References

Audsley	The Art of Organ Building, Two Volumes.
Audsley	Organ of the Twentieth Century.
Hopkins and Rimbault	The Organ.
Goodrich	The Organ in France.
Galpin	Old English Instruments of Music.
Sachs	Real-lexicon der Musikinstrumente.
Grove's Dictionary	*Articles*: Organ, Pedals, Bellows, Great Organ, Swell Organ, Choir Organ, Echo Organ, Coupler, Mixture, Registration, J. S. Bach, Buxtehude.

Chapter V

THE PIANO AND ITS PREDECESSORS

"I look for homogeneity of materials and equipoise of means and end. Mozart's music and Mozart's orchestra are a perfect match, and I find a similar correspondence between Chopin's piano and some of his Etudes and Preludes."

—*Richard Wagner.*

SEATED in the concert hall we listen to the infinite variety of dynamic effects brought forth by the skillful pianist from his instrument, as he faithfully follows the mood of the composer. Our pulses quicken when the crashing fortissimo chords strike our ears, and again we hold our breath in suspense as the delicate arpeggios fade away until they reach the borderland between sound and silence. We are filled with gratitude to the composer and admiration for the virtuoso, who is accordingly called forth again and again.

This is no more than rendering tribute to whom tribute is due, and yet how rarely are the merits of those important factors, the artisans who created the mechanism, taken into account! It is doubtful whether we can ever be brought to realize fully how

deep are our obligations to those men who, from past ages up to the present time, have spent decades of thought and labor in evolving the many features of the Pianoforte* and bringing it to its present degree of perfection. Without their efforts we should be unable to enter into communication with the composer, while he on the other hand, deprived of the inspiration afforded by the instrument, and a realization of its capabilities, would never be able to express his thoughts and feelings, which on being reproduced, awaken in us similar emotions.

From the "twanging and the clanging of the heavy, brazen bells" to the delicate upper tones of the Piano, there is a vast difference in quality and volume, and yet these sound-producing media are related, although distantly, for in each the principles of percussion are involved and all such may trace their ancestry back to the Pien-King one of the oldest, if not the most ancient of instruments known, the Chinese claiming that it was invented from 4,000 to 4,500 years ago. (See page 21).

The Predecessors of the Pianoforte

From that remote period when tones were first awakened by the vibration of a string, to the present day, countless inventions have appeared, many of

*This, an abbreviation of the original term *Piano e Forte*, has been practically superseded by the briefer term *Piano*, which will be employed here. In the 18th century the term *Forte Piano* was often used.

which have exerted an influence upon the evolution of the most complete and available of musical mediums. Although the more important of these devices have already been discussed, it will be well to bring once more into brief review these worthy predecessors of the Pianoforte.

VIRGINAL, OR SPINET, BY ANDREAS RUCKERS, 1610
(*Leslie Mason Collection, Museum of Fine Arts, Boston*)

By glancing at the table of Stringed Instruments on page 60 it will be seen that section *a* is devoted to those that are plucked, while section *c* comprises such as are struck. Of all these instruments those that were most closely related to the modern Piano-

forte were the Psaltery and the Dulcimer. As was shown on page 76 these instruments were very similar, the chief difference consisting in the manner of playing them; the strings of the Psaltery being *plucked* with a plectrum of ivory, metal or quill, while those of the Dulcimer were *struck* with small hammers held, one in each hand.

It was shown in Chapter III that the Psaltery was the forerunner of the Spinet, the tones of which were produced by a series of jacks controlled by keys, while the Dulcimer was the immediate ancester of the Pianoforte, the tone-compelling hammers being set in motion also by keys.

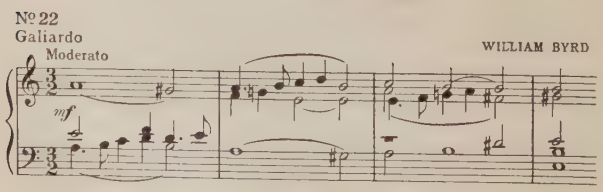
The Spinet

In the Spinet, the jacks that replaced the plectrums

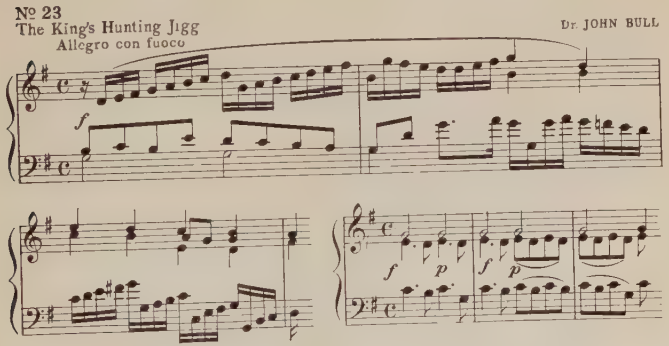
SPINET BY BAKER HARRIS, LONDON, C. 1750
Compass four octaves and three notes. 3 ft. 7⅞ in. long
(*Boston Museum of Fine Arts*)

of the Psaltery were adjusted to the keys. These jacks were usually made of pear-tree and rested on the back end of the key lever, which was of the most primitive form, and had movable tongues of holly, working on a center which was kept in place by a brittle spring. A thorn or spike of crow-quill projected at right angles from the tongue.*

On the key being depressed, the jack was of course forced upward, and the quill brought in contact with the string, which was thus thrown into vibration. When the key returned to its level the jack followed it and descended; and the quill then passed the string without resistance or sound. It is not known when the jack was introduced, but the supposition is that it was during the fourteenth century. The oldest Spinets were without covers, and resembled Dulcimers. In many instances the terms Spinet, Harpsichord and Virginal were used interchangeably. There seems, however, to have been this distinction, that a Spinet had but *one wire* to each key, whereas the Harpsichord had *two unisons.*

Example No. 22 shows a bit from a Galiardo by

*See page 77 for derivation of the terms *Spinet* and *Clavichord.*

William Byrd* (1542-1623). It will be noticed that whereas in music for Psaltery or Dulcimer only two parts were available (one being played with each hand) in these measures for Spinet, controlled as it was by a keyboard played with several fingers,† there are three and four voice parts. The extract also shows the influence of the ecclesiastical style of which Byrd was also a master, he being an organist as well as a Spinet player.



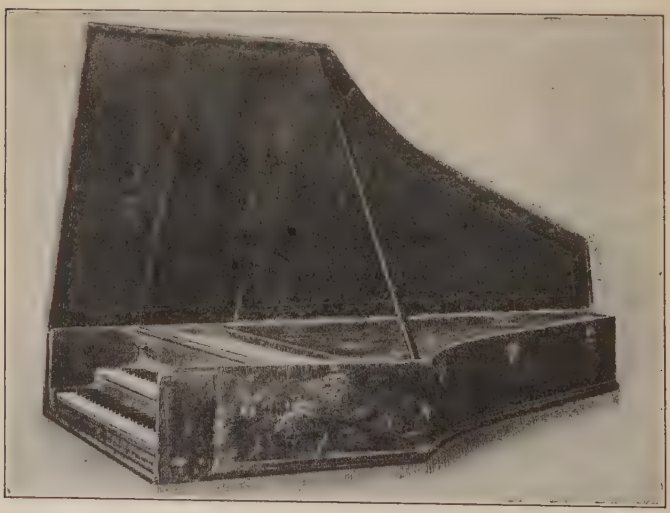
The possibilities of virtuoso passages on the Spinet may be realized from the selection (No. 23) from *The King's Hunting Jigg*, by Dr. John Bull, organist and Virginal player to Queen Elizabeth and King James I. So great was his mastery of the Spinet that he has been referred to as "the Liszt of his day." The closing measures doubtless were suggestions of the huntsmen's horns.

*Byrd from his variety of accomplishment and length of life was a central figure in the Elizabethan period.

†The thumb, however, was rarely used.

The Harpsichord

The strings of the Harpsichord were arranged in a manner similar to those of the modern Grand Piano. In front, immediately over the keys, was the wrest-plank with the tuning pins inserted, round which were wound the nearer ends of the strings, the further ends being attached to hitch pins driven into the sounding board itself. It is obvious therefore, that the tension applied could not be very great, otherwise the sounding board would be ruined.



HANDEL'S HARPSICHORD, MADE BY ANDREAS RUCKERS, 1651
(*Victoria and Albert Museum, London*)

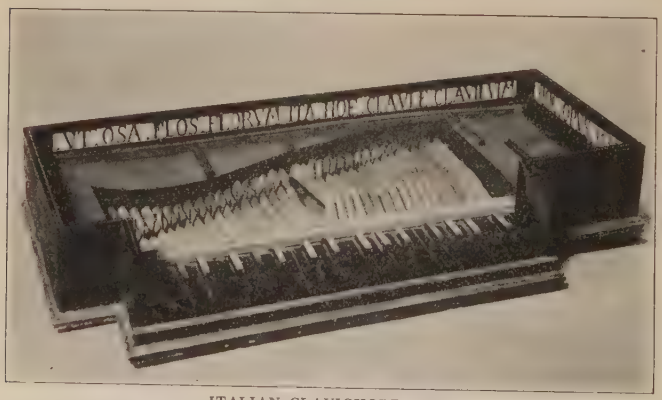
The Ruckers family, who lived in Antwerp between the years 1579 and 1650, achieved a great reputation as Harpsichord manufacturers, and owing to their

many improvements, brought the instrument to a high degree of perfection. Hans, the eldest, added to the two unison strings of each note a *third* of shorter length and finer wire, tuned an octave higher, *thus increasing the power and brilliancy of tone.* To employ this extra series of strings at will, alone or with one or both the unison strings, a draw stop, similar to those of an Organ, was introduced. Shudi, a London manufacturer (1769) patented a Venetian swell, an adaption from the Organ to the Harpsichord. Kirkman, another London man, added a pedal to raise a portion of the top or cover, also for the purpose of increasing the sound. Both used two pedals; the one for the swell, the other to shut off the octave and one of the unison registers, leaving both hands free. We see then the germs of the modern damper pedal, as well as a foreshadowing of the Pianoforte itself.

The Clavichord

The Clavichord differed from the Spinet in that the wires were struck by tangents, thus introducing the principle of percussion in place of the plectrum. In shape the Clavichord has been followed by the square Pianoforte, of which it was the prototype. The case was oblong, and was placed upon a stand or legs. The length, according to the compass and period of construction, was from four to five feet; the breadth, of less than two feet; the vertical depth

of case, five to seven inches. The keys were in front, and extended beneath the sound board to the back of the case, each being balanced upon a wire pin, and prevented from rattling against its neighbor by a small piece of whalebone projecting from the key and



ITALIAN CLAVICHORD, 1537
(*Crosby Brown Collection*)

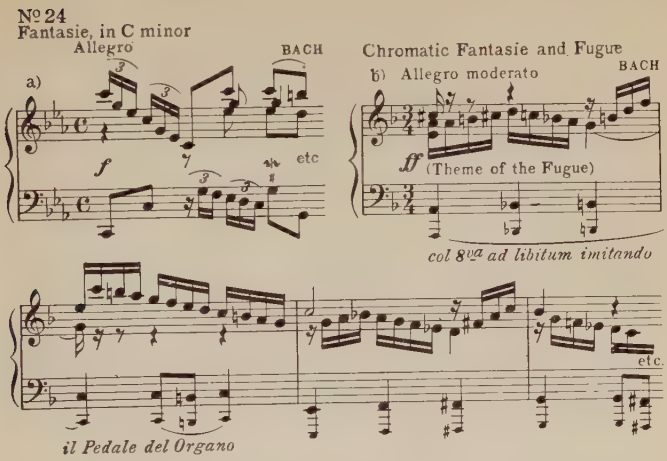
sheathed in a groove behind. The lower, or natural, keys were usually black, and the upper, or chromatic, white. In Italy and the Netherlands the practice was the reverse. The strings of finely drawn brass wire were stretched nearly in the direction of the length of the case, but with a bias toward the back. Nearly at the back of each key, in an upright position, was placed a small brass wedge, or "tangent," about an inch high and an eighth of an inch broad at the top. The tangent, when the key was put down, rose to the string and pressing it upward, set it in vibration. With a good touch the player could feel the elasticity

of the string, and the more this was felt the better the instrument was considered to be. By the pressure of the tangent the string was divided into two unequal lengths, each of which would have vibrated, but the shorter was instantly damped by a narrow band of cloth interlaced with the strings, which also damped the longer section directly the player allowed the key to rise and the tangent to fall. The tangents thus not only produced the tones, but served as a second bridge to measure off the vibrating lengths as the frets of the Lute required for the pitch of the notes. Thus a delicate tone was obtained that had something in it charmingly hesitating or tremulous; a tone, although very weak, yet capable, unlike the Harpsichord or Spinet, of increase or decrease, reflecting the finest and most tender gradations of the touch of the player, and was in this power of expression without a rival until the invention of the Pianoforte. An admired effect of the Clavichord was a change of intonation caused by a strong pressure of the key, which displacing a little the point of contact of the tangent, tightened the vibrating part of the string, thus making the note very slightly sharper in pitch. Another feature which Beethoven endeavored to imitate on the Pianoforte, was a repetition of a note without quitting the key, an effect which could not be produced upon the Harpsichord.

It may be seen, therefore, that both the Harpsichord and Clavichord had their characteristic excel-

lences and also their weak points. It was but natural that the mechanical musicians sought to invent an instrument which would combine the salient features of both with the defects of neither.

Equal Temperament

The title *Well-tempered Clavichord* is familiar to all, and some of us realize that this unapproachable group of forty-eight Preludes and Fugues was written by Bach to enforce the employment of the equal temperament and to utilize all the known major and minor scales. But not everyone has stopped to notice that each number was written within the compass of four octaves. "By working within limitations the Master shows his powers." (*In der Beschränkung zeigt sich erst der Meister*). Thus said Goethe and if anyone ever demonstrated the truth of this aphorism it was Bach. The opening measures of the *C-minor Fantasie* (*a*) exhausts this range at one sweep, and the fragment from the great *Chromatic Fantasie and Fugue* (*b*) shows that this too was written within the same confines, inasmuch as the modern editor apologizes for bringing the fugue theme in octaves "in imitation of the Organ pedals."

That there were many attempts to produce a Harpsichord with hammers is very evident, not alone from the conflicting claims of various nations, but it is in the nature of things that whenever a universal want is felt, more than one man thinks he alone has the first solution to the problem.

The chief difficulty to surmount in introducing hammers into the Harpsichord was the great increase of tension (which would endanger the sounding board), owing to the heavier wires and greater force of the blow than that needed in the Harpsichord or Spinet, and the greater distance through which the hammer must pass, thus necessitating a stronger frame than was possessed either by the Clavichord or Harpsichord.

The Piano e Forte

These obstacles were at length successfully overcome by Bartolomeo Cristofori, a Florentine Harpsichord maker, who in 1720 made the *Piano e Forte* shown here. It has a range of fifty-four notes while the Piano of today has eighty-eight.

PIANO E FORTE BY CRISTOFORI, 1720
(*Crosby Brown Collection, Metropolitan Museum*)

As stated before, other artisans had been experimenting about the same time in the endeavor to construct a satisfactory Harpsichord with hammers. A French Harpsichord manufacturer, Marius, designed as early as 1716 four models for hammer-harp-

sichords. Schroeter, a native of Saxony was also interested in combining the characteristics of the Harpsichord and Clavichord about this time, and in 1721 deposited at the Saxon Court the models of two hammer actions, one overstriking, the other understriking. Owing to the position of the damper, no sustained tone was possible. It was owing to defects of this kind that we find the works of writers of that period so full of mordents, turns and pralltrillers, the object being to prolong the tone.

It seems that owing to the opposition from the performers on the Clavichord in Italy, an opposition that every new invention is liable to awaken, the manufacture of Pianofortes began to decline some time after the death of Cristofori, although he had a number of followers. That his system, however, took root in other soil may be seen from the action of the Piano made by the celebrated German manufacturer, Silberman, in which the fundamental principles of the Cristofori mechanism were applied.

The Pianofortes heretofore mentioned were all in shape like the Harpsichord, triangular or wing shaped (hence the German name *Flügel*).

The Square Piano

In the latter half of the eighteenth century, Johannes Zumpe, of London, began the manufacture of Pianos in the form of a table. Indeed, these square Pianos were occasionally fitted with drawers

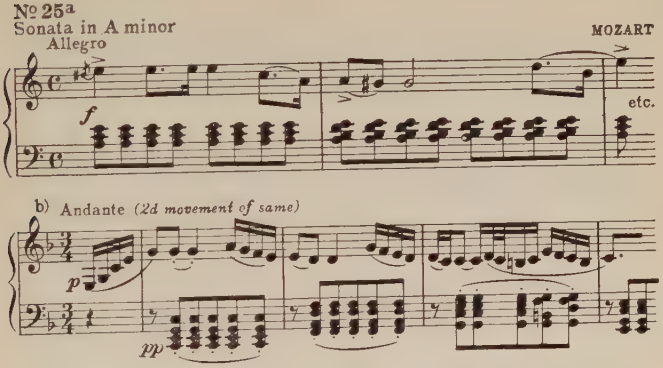
and made to look like tables, and are still called in Germany *Tafelklaviere*—Table-pianos.

Although the *Flügel,* or wing-shaped Piano, had been the original form employed, the action of the Grand Piano was not known until about 1776. Its invention is attributed to a Dutchman, Americus Bachers. It is an improvement of Cristofori's first idea and was ultimately known as the "English action," as it was called on the Continent.

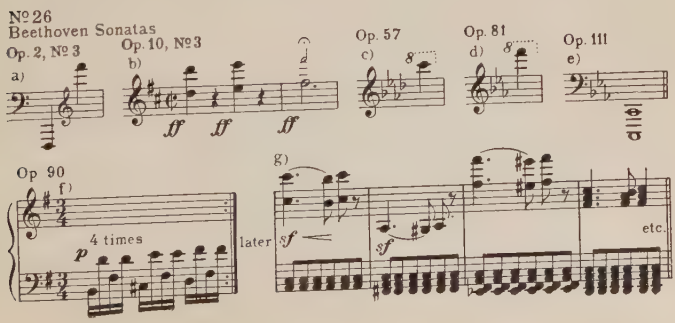
English and German Piano Actions

Mr. John Broadwood, of the celebrated house of John Broadwood & Sons, together with an apprentice, Robert Stodart, assisted Bachers to perfect this action, which has held its own up to the present time, having been endorsed by Chopin and other leading pianists. In Germany, one Stein employed an action in which the escapement differs from both Cristofori's and the English action. From the resulting difference a radical change of touch took place, and an extreme lightness became the characteristic of the Viennese action as developed by Andreas Streicher, Stein's son-in-law. This lightness of touch in such contradiction to the heavy action of the English makers was very emphatically commented upon by Carl Maria von Weber while in England. The fragments from Mozart's *Sonata in A-minor* show the delicacy of action and light tone of the Vienna Piano, but passages like that

at No. 25b would have been unendurable to the hypersensitive ears of Mozart could he have heard them on a modern grand.



In all probability there never was a period in the history of the Piano marked by such vital changes as that which was coincident with Beethoven's career. By taking distinctive features of his Sonatas from Op. 2 to Op. 111 we can form an idea of the remarkable growth of the instrument with respect to compass and sonority.

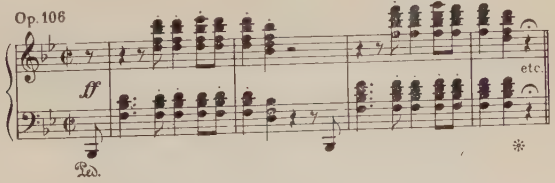


Beethoven utilized all available tone-producing instruments to the utmost, and we see that in his very first Sonatas for the Piano he exhausted its five-octave range (see No. 26*a*). In Op. 10, No. 3, the composer suggests in a small note a high F♯ (see *b*) as much as to say, "In case it exists in your instrument." Possibly the suggestion was a prophecy or the key may have been introduced in a few specimens. Not till Op. 57 do we see higher tones, when the *c* above high *c* is demanded. (See *c*). In Op. 81 we find the *f* above this (see *d*) giving a range of six octaves while in the last page of Op. 111 may be seen the note an octave below low *C* in the bass (see *e*).

In the year 1816 when Op. 90 appeared, the tone of the Piano had evidently grown materially, for we notice an effort to distribute the chords somewhat after the manner of later writers. Compare *f* with Nos. 27 to 30. Nevertheless, at *g* a group of thick, heavy chords appear in the bass again, due to two causes: first, it was a survival of earlier methods; second, the hearing of the composer was so impaired that he resorted to an ear trumpet and frequently gave voice to regrets at the loss of his fine powers of discrimination. These passages *looked* well on paper, and he doubtless hoped they *sounded* as well, although he could not hear the muddy effects on the more modern Piano.

Damper Pedal

The damper-pedal (patented by Broadwood in 1783) was a great factor in magnifying the tone. It was no longer necessary to keep up a constant repetition of chords as in No. 26*g* or broken up after the manner of the older writers (called by the French

batteries) but new figures and phrases were invented and applied. Beethoven received a gift of an improved Grand Pianoforte from Mr. Broadwood while he was writing the great Sonata Op. 106, and we feel the effects of his influence at once. Observe the wide leaps of the bass with the pedal sustained through the opening four measures.

Helmholtz calls especial attention to the harmonics generated by the lower tones of the Piano, while in the upper registers they are few in number. "In the lower octaves the second and third harmonics are often as strong, the second in fact even stronger, as the fundamental itself." This being the case it is ob-

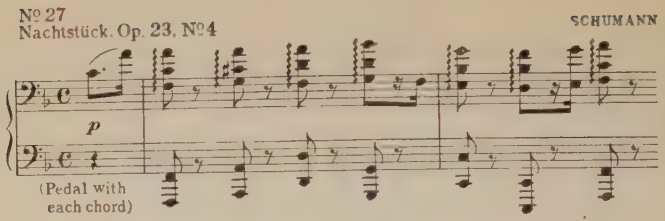
vious that when the damper pedal is raised the generation of overtones is greatly increased. (See p. 47.)

HAYDN'S PIANO—CONCERT GRAND OF FIVE OCTAVES
Black naturals, white sharps and knee-pedal
(*Steinert Collection, Yale University*)

Suggestions From Nature

Whoever inspects an illustrated history of costumes is amused at some of the weird methods employed by human beings to clothe and decorate themselves. It seems strange that apparel grotesque in the extreme could have been worn by serious-minded beings; strange that people were attracted to that which was ugly because it was new, and how those who disliked it at first became inured to it through habit. But granting the gratification of the love for the novel to be truly justifiable, it is significant that the classic garments of the Greeks and Romans always present a pleasing appearance, and that every now and again fashion makers revert to them as a safe resort. And why are these habiliments so refreshing to the eye? Because they more than any others permit the human figure to serve as the main theme of the composition, while the draperies delicately furnish the subordinate motives—the flowing lines idealizing or obviating any angularities due to the motion of the limbs.

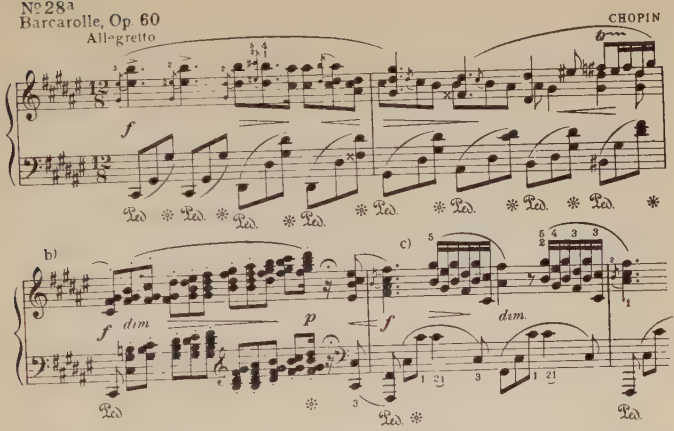
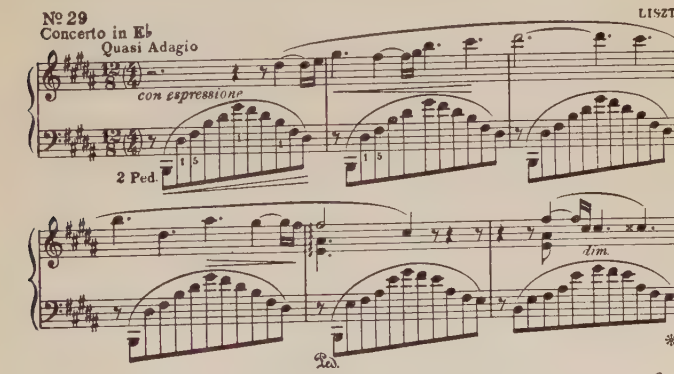
Thus too is it with the distribution of the tonal masses. The nearer we approach the suggestions of Nature, the more nearly do we approach ideal chord-construction. Compare the harmonies from the fourth *Nachtstück* (Night Vision) by Schumann and see how remarkably they suggest the tone series given on p. 47.

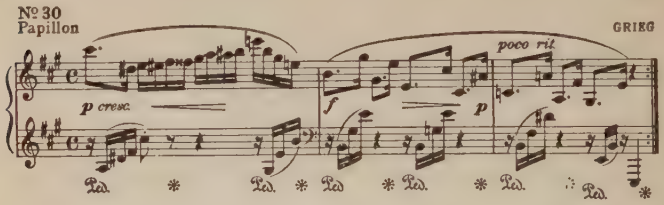


See how carefully Schumann avoids putting the third of the chord in the lowest register, and if we play (applying the pedal) each chord slowly, the order of the Nature series is felt to be the guiding power.

Chopin's use of the Pedal

Again, observe the wide oar-like sweep of the bass (at *a* and *c* in No. 28) in the excerpt from Chopin's *Barcarolle* (a pedal with each beat). Watch especially the remarkable building up of the rich harmonies at *b*. The melodic outline is a simple scale of *F♯-major*, while the inner parts form a chord of the dominant 11th (with a slight hint at a 13th). Notice that instead of a *crescendo*, as the voices ascend, there is a *diminuendo*, a suggestion of hazy overtones—and yet, Chopin never indulges in smears, blurs or smudges. You can always play his works *slowly* and enjoy their wonderful harmonic evolutions.*

*See *Chopin the Composer*—E. Stillman Kelley, p. 163.

None of Chopin's colleagues carried out this chord dispersion more beautifully than did Liszt, as these measures from his *Eb Concerto* testify.

A worthy successor of these great composers for the Piano was Grieg who, while following their general style and methods, was able by virtue of his genius to add a number of novel, legitimate effects.

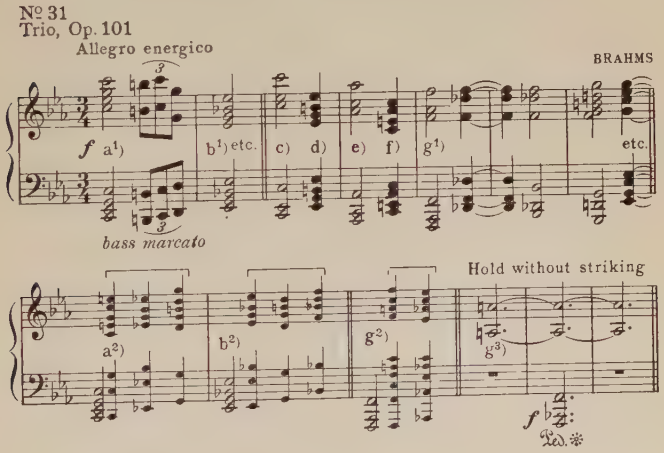
But he too was a master, devoted to the suggestions of the Nature series. See the excerpt from the familiar *Butterfly*.

Among the more recent writers, Edward MacDowell may be cited as one who possessed a special gift for sonorous tone combinations. The student may easily verify this by taking at random almost any piece wrought by this composer.

Reactionary Methods

In the light of these revelations, that show a few points in which the so-called Romantic School had made genuine advances on the achievement of the Classical, it seems singular that so scholarly a composer as Brahms, who had such intimate relations with Robert and Clara Schumann, should not have shown more sympathy with the Romantic movement.*

But if we glance at certain typical chord formations such as we find in this excerpt from his *Trio*,

*Richard Wagner was present when Schumann's epoch-making Quintet was first given in Dresden. In an enthusiastic letter to the composer he exclaimed, "The first two movements are continually running through my mind. I see in what direction you are going and I assure you that thither too will I go; it is the only artistic salvation—*Beauty*!"

Op. 101, we are forced to believe that he either had little sense of sonority or his resistance of the Wagner-Liszt tendencies was so intense as to drive him into ultra-classical methods.

These chords produce a gray, growling, grummy effect because of the jarring of conflicting overtones generated by closely lying fundamentals. No. 31 a^1, the tones *C*, *E*♭ and *G* create *three sets* of overtones shown at a^2 where the *E*♮ is at war both with the *E*♭ and *D* in the treble. The chord at No. 31b^1 produces the series at b^2, equally disturbing. The chord at g^1 produces the series at g^2. To show that we hear *A*♮ in the treble as well as the *A*♭ in the bass we need but hold the octaves in the right hand *without sounding* them, then strike the chord below, and, quickly shutting off the low *F* and *A*♭ we hear the upper two

A's by means of the sympathetic vibrations, generated by the low *F*. The student may construct for himself the series of overtones arising from the chords at *d*, *e* and *f*.

Brahms is at his pianistic best when, abandoning his parallel thirds and sixths, he expresses himself in those Schumann-like arabesques which we find in some of his later pieces for Piano and the accompaniments to his more atmospheric songs.

In closing, the attention of the student is called to the influence which the development of the Piano has exerted on the literature of music. This influence has by no means been confined to works written for the Piano, but has extended to a multitude of compositions for chorus and orchestra, as well as to those written for performance in connection with the stage.

American Improvements

The extremes of heat and cold characteristic of the American climate, which proved so detrimental to the European Piano when transferred to this country suggested the idea of strengthening the instrument. Accordingly Jonas Chickering of Boston produced, in 1837, a Square Piano with an iron frame, a device which he afterwards introduced in his Grand Pianos. In 1855 the firm of Steinway and Sons of New York combined the iron frame with an *overstrung bass*, a system that has since been employed by makers here and abroad. The Steinways among other im-

provements added two important inventions,—the *agraffe* (or metal stud) bridge and the *sustaining pedal.* The latter enables the performer to hold down a tone in the bass while various harmonies are produced in the upper register.

Questions for Review

1. Mention some of the more immediate predecessors of the Pianoforte.
2. What was the relationship of the Psaltery to the Spinet?
3. What other names were applied to the Spinet?
4. Describe the Harpsichord and tell how its tones were produced?
5. Describe the Clavichord.
6. What is the Equal temperament?
7. Give the compass of Bach's Clavichord.
8. Who was the first to furnish the Harpsichord with hammers and when?
9. What did he name it, and why?
10. Who made the first square Pianos?
11. Where and when were they made?
12. When was the Grand Piano action first invented?
13. Wherein did the actions of the English and German actions differ.
14. Explain why the full chords in the bass that sometimes appear in compositions of Mozart and Beethoven were agreeable when played on the light-actioned piano of the day but are unpleasant when played on a modern Grand Piano?

15. Tell something of the gradual growth of the Piano's compass, as demonstrated in the works of Beethoven.
16. What is the great advantage of the Damper pedal?
17. What in a general way are the best means of dispersing harmonies for the Piano?
18. Explain why the chord distributions of Chopin, Schumann, Liszt and Grieg excel those of Brahms.
19. Which method is followed by MacDowell?
20. In listening to the compositions of Wagner and following his richly sweeping harmonies does he seem to be more in sympathy with Chopin and Liszt, or with Mendelssohn and Brahms?

References

Bie	History of the Pianoforte.
Hipkins	History of the Pianoforte.
Hamilton	Piano Music: Its Composers and Characteristics, Chapter I.
Galpin	Old English Instruments of Music, Chapter VII.
Stanford and Forsyth	History of Music.
Spillane	History of the American Pianoforte.
Finck	Life of Liszt.
Kelley	Chopin, the Composer. Chapters on the new Pianoforte, and Chopin's influence on others.
Mason	From Song to Symphony, Chapter IV.

GROVE'S DICTIONARY

Articles: Clavichord, Harpsichord, Spinet, Pianoforte, Ruckers, Cristofori, Silbermann, Broadwood, Chickering, Steinway, Grand Piano, Pianoforte Playing, and biographical sketches of performers mentioned.

ILLUSTRATIVE RECORDS AND ROLLS

Records:

V—Victor; B—Brunswick; C—Columbia; E—Edison.

Rolls:

A—Ampico; D—Duo-Art; M—Melodee; Q—QRS. W—Welte-Mignon.

MUSIC MENTIONED IN CHAPTER V

BEETHOVEN—Sonata. Op. 10, No. 3 Q.
BEETHOVEN—Sonata. Op. 57 D, Q.
BEETHOVEN—Sonata. Op. 90 W.
BEETHOVEN—Sonata. Op. 106 Q.
BEETHOVEN—Sonata. Op. 111 A, D.
CHOPIN—Barcarolle, in F♯ min. Op. 60 A, D, Q.
GRIEG—Butterfly (*Papillon*). Op. 43, No. 1 C, E, V; A, D, M, Q, W.
LISZT—Concerto No. 1, in E♭ A, Q, W.
SCHUMANN—Nightpiece (*Nachtstuck*). Op. 23, No. 4 A, D, Q.

Chapter VI

THE VIOLIN FAMILY

"The instrument on which he played
Was in Cremona's workshops made."
—Longfellow, *Tales of a Wayside Inn.*

IN tracing the development of those sound-producing media which have made possible our modern orchestras, and rendered the art of music worthy of a place beside its sisters—poetry, acting, painting, sculpture and architecture—there is probably no one locality that has played so important a role in this evolution as Cremona in Northern Italy. This distinction was earned for that city by a long line of artistic inventors to whom we owe what is considered the most expressive of our musical instruments, the Violin.

When we discuss the Violin, we naturally include its kindred—the Viola, Violoncello, and Double Bass—for this family has served as the foundation of the orchestra from the time of their introduction to the present day. Furthermore, the Violin was the first instrument of our modern orchestra to attain perfection, and in describing its characteristic fea-

tures and musical possibilities, it will be noted that these details will—in a general way—correspond to those of the other members of the group.

Historical Notes

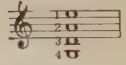
The name of Gaspar da Salo is associated with the primitive Violin, but the first maker of the instrument as we now know it was Andreas Amati, concerning whom little is known save that he died about 1577. Not only his brother Nicola, but his sons, Antonio and Geronimo, as well as his grandson Nicolo (1596-1684) were master builders of the celebrated "Cremonas," while the last named numbered among his pupils Guarnerius and Stradivarius, who carried the art to its ultimate perfection.

Details such as quality of the wood, character of the varnish, shape of the back, belly, and sounding-board; position of the bridge and sound-post, the curve of the *f* holes—all these demanded and received the most careful consideration. Some seventy pieces of wood were required in the construction of the Violin, and the manner of disposing of them was subjected to mathematical calculation, due attention being paid to the laws of acoustics. Statisticians are fond of showing that while the raw materials of which a Violin is composed might be purchased for about five dollars, they become, after being fashioned by genius and seasoned with age, instruments of beauty

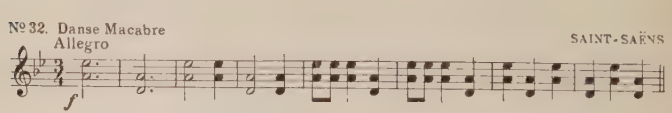
that are valued from $1,000 to $2,500 while fancy prices of $20,000 and upward are paid by connoisseurs.

Tuning

The Violin has four strings of gut, the lowest being wound with metal, usually silver. Of late metal strings have been tried. The traditional tuning is in fifths, and the strings are numbered from above downwards.



Paganini and other great virtuosi have varied this tuning somewhat, usually by raising the pitch to secure greater brilliancy of tone. Saint-Saëns, on the contrary, in the score of his *Danse Macabre* requests the leading first violinist or concert-master to lower the upper string to *E*♭ in order to suggest the grotesque fiddling of the Grim Reaper seated on a tombstone. (See No. 32).

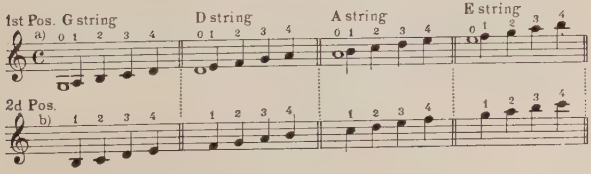
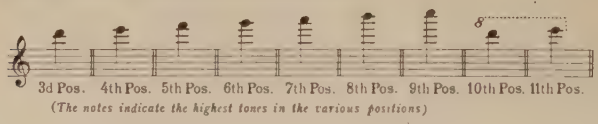


Scale Building

In Chapter III mention was made of the fact that one of the chief differences between the Viol and Violin families consisted in the fact that whereas the former were provided with frets, or finger guides, the latter had none. This, as will be seen, exerted a significant influence upon the technique of the Violin,

for the performer is obliged to make his own scales, which involves a keener perception of pitch than is required where the tones are already at hand, as is the case with the Piano and Organ.

Coincident with the training of the ear is the cultivation of the sense of touch. We read of certain dealers in textiles who acquire such acuteness of this faculty that by feeling a piece of silk or linen they can estimate the number of threads to the inch. A similar accuracy of space measurement is required of the violinist to enable him to calculate the smaller intervals upon the fingerboard, especially in the higher registers where they are quite minute.

Taking the open strings as a starting point, the various scales are produced by shortening or stopping the strings with the tips of the fingers at various distances from the bridge. At *a* in the subjoined table we have the series of the *first position;* at *b* we have that of the *second position.* It will be seen that a "position" implies the series of consecutive tones that can be played by the fingers 1, 2, 3 and 4 of the left hand on the *G, D, A* and *E* strings, without shifting the place (position) of the left hand.

The highest tone producible in the third position is the next *d* in the ascending scale.

(The notes indicate the highest tones in the various positions)

The fourth and fifth positions enable the player to reach the *e* and *f* above, while the sixth, seventh, eighth and ninth positions make it possible for him to attain the still higher *g*, *a*, *b*, and *c*. Beethoven was evidently the first to demand this *c* in his *Egmont Overture*. The culminating chord in the *Tannhäuser Overture* required the *e* above (eleventh position) and since the appearance of that work Wagner and later writers have demanded still higher tones.

Double Stops

Combinations of two tones are of course easier when one of them is produced on an "open" string, but all major and minor sixths are quite feasible.

Chords of three and four tones, or triple and quadruple stops are also valuable tone combinations at the disposal of the composer. Owing to the convexity of the bridge it is obvious that the bow can come in contact with only two strings at once, but when the performer gives a firm sweeping movement across the strings, the bow can *arpeggiate*, so to speak, chords of three or four tones. An orchestral group, playing

in this manner, can evolve a *fortissimo* of terrific intensity.

It sometimes occurs that in a passage difficult or impracticable for one player to perform, it is simplified by dividing it, so that (there being two players at each desk) one plays the upper part while the other takes the lower. Such passages are marked *divisi.* This method is applied not only to the Violins but to Violas, 'Cellos, and even the Double Basses.

Harmonics

According to the principle elucidated in Volume I of this series—Chapter VII—a string divided into *two* parts yields the octave above, divided into *three* the twelfth above, into *four* parts the double octave, etc.* A similar series of tones is obtained if, instead of pressing the string down *to* the fingerboard, the fingers lightly *touch* the string at the point that divides it into 2, 3, 4, 5, and 6 parts. The difference in the result consists in the quality of tone, which is of a flute-like character; indeed, these tones are called in Germany *flageolet tones,* and in English they are termed *harmonics,* and are indicated by a zero sign (0) placed above the note that is to be thus rendered.

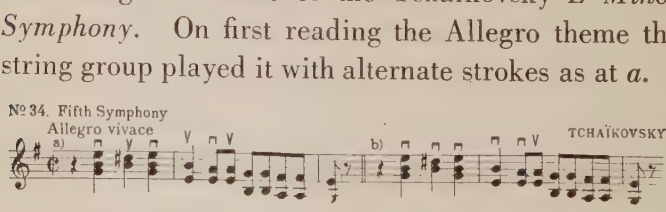
A remarkable instance of the employment of these

*See Gehrken's *Fundamentals of Music.* p. 163-165.

natural harmonics may be seen in the score of Rimsky-Korsakoff's *Capriccio Espagnol.*

Bowing

While the Orientals employ the bow in an indiscriminate see-sawing upon the strings, our European composers and performers take great pains to mark the downward and upward stroke, the former by the mark ⊓ or ⊔, and the latter by the sign ∨ or ∧ True, one concert-master carefully indicates these movements in the string parts in what he considers the most effective manner; while another takes the same parts and marks them quite otherwise, in some cases exactly the reverse of the former. A striking difference between these two methods of producing the tone in respect to quality and volume is sometimes manifest. I once had occasion to observe this while rehearsing the Finale of the Tchaïkovsky *E Minor Symphony.* On first reading the Allegro theme the string group played it with alternate strokes as at *a.*



I then asked the players to observe the composer's bow marks, as at *b,* and the result was about double

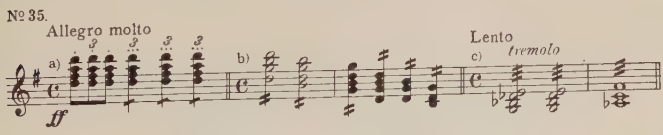
the sonority, so much stronger was the down-stroke than the up-stroke.

By carefully utilizing the various bow strokes, observing the interchange of legato and staccato, an infinite variety of phrasing is possible.

Tremolo

A valuable feature of the Violin technique consists in the rapid repetition of one, two or more tones, producing a trembling, appropriate to intensely agitated moods, or again in pianissimo passages in the upper registers it is suggestive of exaltation. We thus find the tremolo employed by the great masters to intensify moods varying from the contemplation of the Holy Grail, to Hagen's murder of Siegfried.

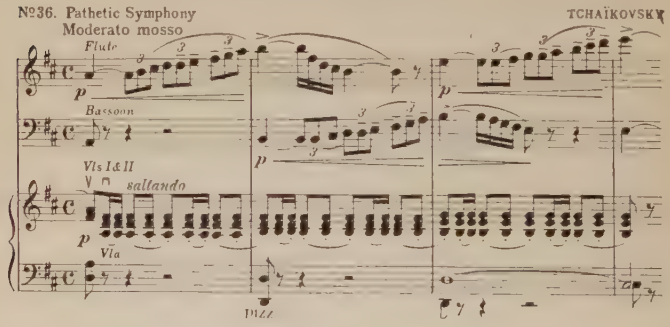
Beside the measured tremolo, where a definite number of tones are produced, as in the Introduction to Act III of *Lohengrin* (No. 35 *a* and *b*), there is the indefinite tremolo, where we often find the word *tremolo* above the notes in order that the quality of agitation may not be missing (No. 35 *c*).



Saltando or Springing Bow

Akin to the various phases of tremolo is the so-called springing bow, which consists in striking the string with the bow in such a manner as to cause it to

rebound, producing a group of reiterated notes. One of the most effective examples may be found in the closing theme of the first section of the opening movement of Tchaïkovsky's *Pathetic Symphony*.

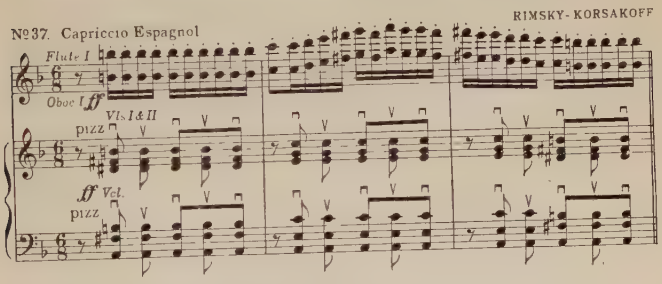


PIZZICATO

An old-time actor once told me of reciting a poem accompanied by the "picked staccato" of the Violins. This expression, although technically inaccurate, is strikingly suggestive, for when the strings of any instrument of the Violin family are played pizzicato, they are picked, and the result is *staccato*.* What is this picking or plucking but a going back to first principles, and setting the strings into vibration without the aid of the bow? (See Chapter III, page 62.)

The usual simple process is so familiar to all that illustration is unnecessary, however, in the works of Rimsky-Korsakoff, the brilliant orchestrator, we find certain remarkable experiments. In his *Capric-*

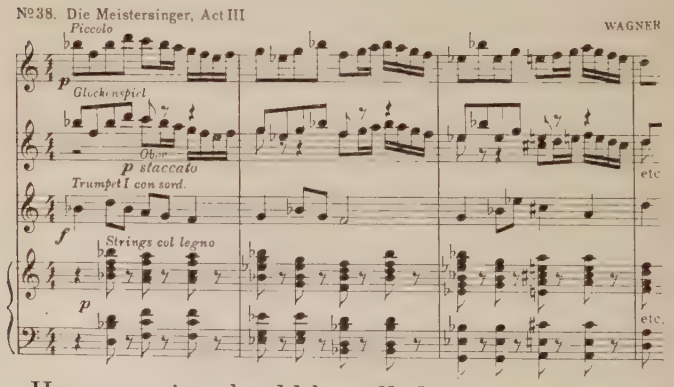
*The abbreviation *pizz.* is used when the strings are to be plucked, after which the word *arco* indicates a resumption of the bow.

cio Espagnol, the composer obtains a startling effect by causing all the Violins and 'Cellos to strike the strings back-and-forth, and to be sure that his intentions are carried out he takes pains to mark them with the *down* and *up* marks used in bowing. (See No. 37).

A further elaboration of the process we find in this great Russian's symphonic poem *Scheherazade*, where he virtually calls for a pizzicato tremolo, but the climax of all pizzicato achievement is to be found in the Scherzo of Tchaïkovsky's *Fourth Symphony* where the entire string group from the Violins to Double Basses play throughout the movement with never a touch of the bow.

Col Legno

Sometimes in order to produce a certain weird and unusual effect the composer demands that the strings be struck "with the wood" (*col legno*) of the bow. So the players apply the back of the bow instead of the hair. This procedure was one of the many original devices employed by Saint-Saëns in his *Danse*

Macabre, one of the most picturesque symphonic poems ever conceived. Wagner calls for the same effect in Act II of *Siegfried*, where Mime is brewing the poison with which he hopes to destroy Siegfried, and again he requests its aid in a more cheerful scene in Act III of *Die Meistersinger*, at the entry of the various Guilds. Here all the strings *col legno* furnish the harmonies, while stopped Trumpets (described in the next chapter) suggest the little toys, the manufacture of which have helped make Nuremberg famous for centuries.



Here attention should be called to the very sparing use by truly great masters of this and kindred highly spiced effects. In the above excerpt the *col legno* is employed for only four measures. Its appearance in the *Danse Macabre* is just as restricted. On the other hand, in the works of the mediocrities, where laboured external effects must take the place of ideas, piquant passages are prolonged till satiety ensues.

The Sordine or Mute

In order to deaden the tone in passages where a pianissimo is desired, a little three-pronged comb-shaped device, usually of metal, is applied to the bridge of a Violin, Viola, 'Cello, and, rarely, to the Double Bass. The effect is often most poetic, and may be regarded as an orchestral whisper.

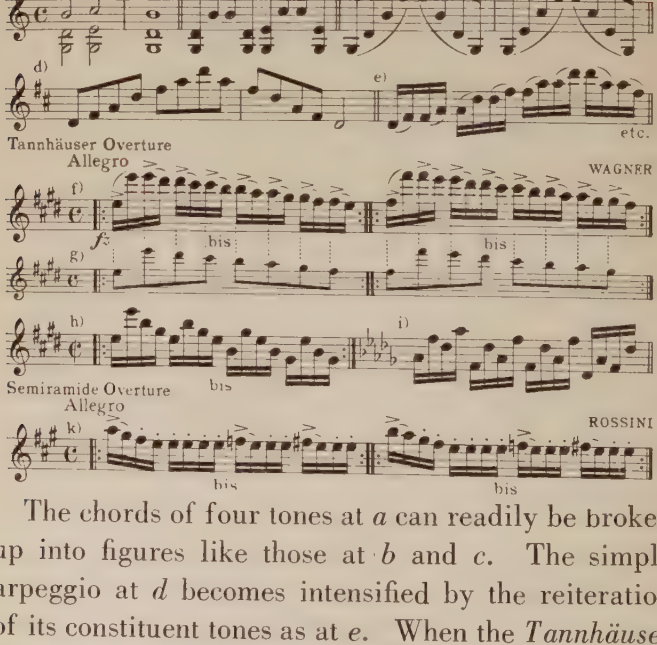
Violin Passages and Figures

As we proceed in our investigation of tone-producing media, we are impressed more and more with the fact that each instrument has its mode of expression, and a musical phrase that is characteristic of one, and easy to play, on being transferred to another often sounds out of place, and is clumsy or difficult to execute.

When given melodic phrases, scale, arpeggio or other passages are especially adapted to the needs or possibilities of the Violin or Piano, they are called in German *violinmässig* and *klaviermässig*, a compact, comprehensive expression for which, unfortunately there is no English equivalent.

Forces move in the line of least resistance, hence the most effective passages for any instrument, are those which are most readily rendered. In the case of the Violin, where the tones must be prepared by the fingers of the left hand, it is but natural that the composer desires to obtain the greatest number of

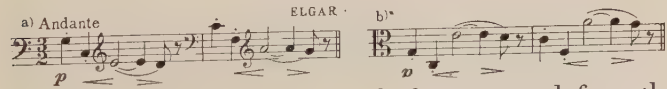
tones possible without "shifting" the hand. This can be effected by repeating a given tone by means of the bow, or by playing tones that surround it. (See No. 39 at *k*).

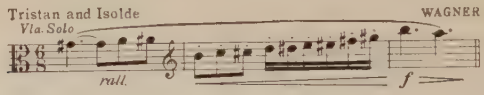


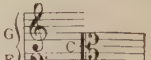
The chords of four tones at *a* can readily be broken up into figures like those at *b* and *c*. The simple arpeggio at *d* becomes intensified by the reiteration of its constituent tones as at *e*. When the *Tannhäuser Overture* first appeared, many performers complained of the difficulty of the Violin figures that accompany the final appearance of the *Pilgrims' Chorus*. But when they realized that the measures at *f* were only the scale passages at *g* amplified, and were strictly in the spirit of the instrument (*violinmässig*) this finale seemed less appalling.

In this connection, attention may be called to the fact that these brilliant Violin figures are ineffective upon the Piano; therefore, Von Bülow, in his four hand Piano transcription frankly substitutes purely pianistic figures such as we see at *h*, with most satisfactory results. These pianistic arpeggios, it is needless to say, would be much more difficult if played on the Violin, while passages in "flat keys," as at *i*, having no open strings, would be very clumsy, not to say impossible, for the violinist.

Viola

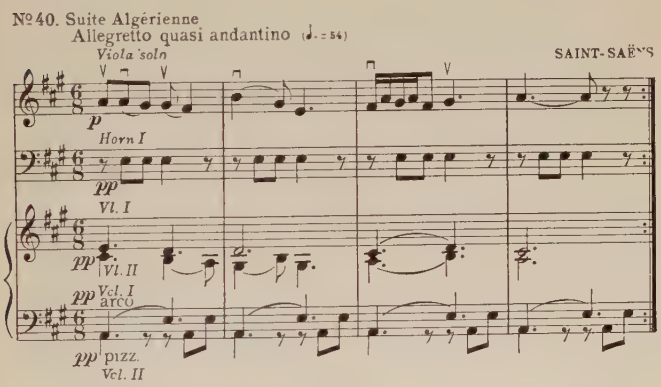
A convenient way of remembering the Viola and its character is to regard it as an instrument like the Violin, but with a compass a fifth lower (See cut on page 138) hence its first and second strings are *A* and *D* while the third and fourth are *G* and *C*. The former two are of plain gut, but the latter are wound with silver wire. As the mission of the Viola is to render the tenor part in a string quartet or a symphony, it is often called upon to play passages with a wide range. Compare the two notations of this passage from Elgar's *Variations*. The first (*a*) jumps from clef to clef, the second (*b*) avoids this by the use of the alto clef.

Such jumping back and forth from one clef to the

other is very trying to the performer, so the alto clef, with middle *C* on the middle (3rd) line is employed when writing for the Viola, except in the very highest register when the composer resorts to the treble clef.

From this it is evident that the *C* clef is not used to make things more difficult. On the contrary, it is a kindly aid. One clef is as easy to read as another, and if the student will but bear in mind that the sign on the *C* clef always indicates *middle C*, and not the *C* of the treble or bass clef, the matter will soon become clear. The alto clef must be thought of as middle *C*, with the two *lower* lines of the *G* or treble clef, combined with the two *upper* lines of the *F* or bass clef.



One of the chief functions of the Viola is providing a rich filling in of the middle parts. Between the upper and lower registers of the orchestra when the Viola moved in octaves with the 'Cello, there was often, in former times an unpleasant gap, but thanks to the efforts of Beethoven and Wagner, more attention has been paid to this valuable orchestral factor.

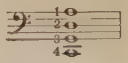
Although the tones of its upper strings are often lost among those of the Violins, the *C* string has such a penetrating quality that it is occasionally employed in passages where the melody is played upon the

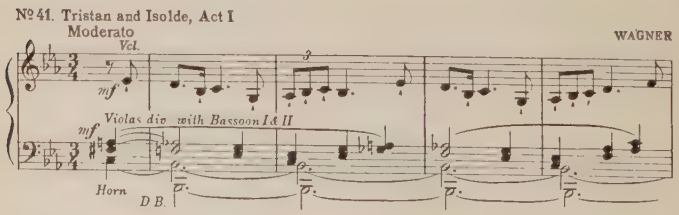
resonant *A* string of the Cello. (See No. 41). But the upper string of the Viola can be made of service rendering a lyric theme with much expression, such as the Oriental cantabile in the Allegretto of the *Suite Algérienne* by Saint-Saëns, who at this point gives the middle parts to the Violins.

The technique of the Viola is in most respects like that of the Violin, and is frequently played by violinists. The chief difference results from the fact that the Viola being larger, the double stops require greater extension of the fingers and some of them are thus rendered rather troublesome.

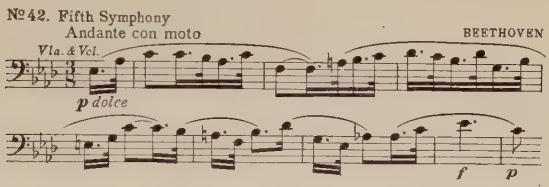
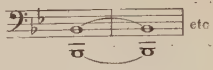
Violoncello

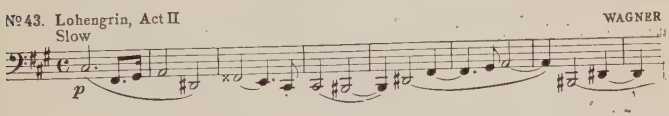
The 'Cello is a much larger instrument than the Viola although its tuning is only an octave lower.

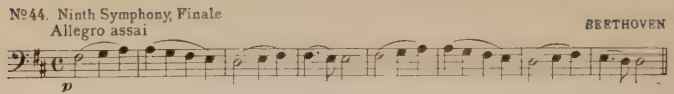
Like the Viola its upper two strings *A* and *D* are of gut, while its lower two, *G* and *C* are wound with silver wire.



The 'Cello possesses far greater individuality than the Viola; has a wider range, and the character of its registers are more highly differentiated. The *A* string has a passionate penetrating quality adapted to the expression of intense emotion. It is sometimes used for the soprano part, while the Viola takes the middle voice. See the well known passage from *Tristan and Isolde*, where the Violas are divided, being reinforced by the Bassoons. The tones of the Double Basses as they sustain the *B♭* are clarified and strengthened by the fourth horn. The passage is a masterpiece of tonal color and balance of the voice parts.

This upper register, suggesting now a feminine voice, and then a young tenor, is supplemented by the lyric quality of the *D* string, with its baritone quality, such as we hear in the opening theme of the slow

movement of Beethoven's Fifth Symphony, in this case doubled by the Violas.

At the close of the lovely slow movement in Schumann's Piano Quartette, he requests the 'cellist to tune down the *C* string to *B*♭, in order to render the long organ point.

In the orchestra, where the Double Bass furnishes the very low tones, there is less occasion for this procedure. I recall only one instance, and that occurs in MacDowell's *Saracens*, where a *B*♮ is called for.

The lower strings, the *G* and especially the *C*, have a rich but gloomy character so well employed in the Ortrud theme in the Introduction to Act II of *Lohengrin*.

Finally, the manly voice of the 'Cello, when united with the Double Bass, becomes serene and even majestic as in the melody from Beethoven's *Ninth Symphony*.

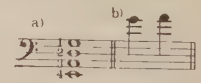


All that has been said in reference to double stops, harmonics, tremolo, pizzicato, etc. in connection with the Violin holds true of the 'Cello, only it should be borne in mind that, owing to its greater size, certain intervals are more difficult to grasp.

The pizzicato, especially in the middle register, is of great value. Without being obtrusive, it "carries" wonderfully well. (See also the pizzicato passage in No. 37).

Double Bass

The Double Bass (*Contra Bass*) is the largest and deepest toned instrument of the Violin family. Its general contour resembles that of the other members of this group with the exception of its back which, instead of being arched, is flat, and is therefore regarded by some as a survival of the Viol family.*

It is tuned at the present day as at *a*: and the notes written sound an octave lower and are therefore of sixteen-foot pitch (see Chapter IV, p. 94).

The upper limit is shown at *b*, but Wagner in *Lohengrin* (Finale Act I) takes them to the *B♭* above, and in later works still higher tones are demanded.

The remarks on bowing, pizzicato, etc., in connec-

*See Chapter III, page 80.

tion with the other members of the Violin family apply here also, excepting in respect to double notes which are rarely ever used, and then only when the lower one is an open string.

The tone quality of the Double Bass is less clear cut and distinct than that of the 'Cello, the very lowest tones being somewhat vague and indeterminate, but when the two are combined, playing either in unison or octaves, the result is a glorious sonority.

Harmonics are also practicable upon the Double Bass although rarely applied. One of the most extensive illustrations of the use of these Double Bass harmonics occurs in the Nile scene in *Aïda* where Verdi calls for the tone two octaves above the open *G* string.

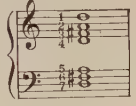
This instrument, so valuable in ensemble and orchestral music, is rarely employed in solos. I recall a concert given by the Italian Bassist Botessini, whose execution was indeed extraordinary, but as he used a small specimen, and cultivated the higher registers, the tones suggested a 'Cello rather than a Contra-bass. The best known contra-bassist of today is doubtless Kussevitsky, whose great virtuosity has however been overshadowed by his achievements as a conductor.

Less Known Relatives of the Violin

A survival of the Viol group is the Viol d'Amour, chiefly known through its use in the first Act of

1. Violin 2. Viola 3. Violoncello
4. Double Bass
(Showing the relative sizes of the instruments and bows)

Meyerbeer's *Huguenots.* Its peculiarity consists in the series of parallel strings beneath the fingerboard that vibrate in sympathy when the outer strings are played. Its seven strings are tuned to produce the following tones:



It is obvious that the composer cannot stray far from the *D-major* triad if he hopes for sympathetic vibrations.

In my student days I attended a concert of the celebrated Professor Hermann Ritter, who demonstrated the characteristics of his improved Viola, which was specially designed for use at the Bayreuth Festival of 1876. This Viola, tuned like that in our orchestras, was intended to remedy the weakness of this instrument. The Ritter Viola possessed indeed a strong tone, stronger than that of the old design, but its size was so increased that only men with long arms could master it, and it soon fell into disuse.

In the collection of musical instruments in the former Royal High School of Music in Berlin, was to be seen the Baryton that once belonged to Haydn. This instrument was one of the Violin family, and its range was between that of the Viola and the 'Cello, but in spite of its popularity in the eighteenth century, it is now practically unknown.

Dynamics

By a judicious modification of the pressure of the bow upon the strings of any member of the Violin

family, a great command of all shadings from *pp* to *ff* is possible, which implies great emotional expressiveness. This dynamic range and the facility of transition from one extreme to the other is scarcely equalled by any other type of instrument. When the entire string group give voice to an appealing theme, the effect is sometimes overwhelming.

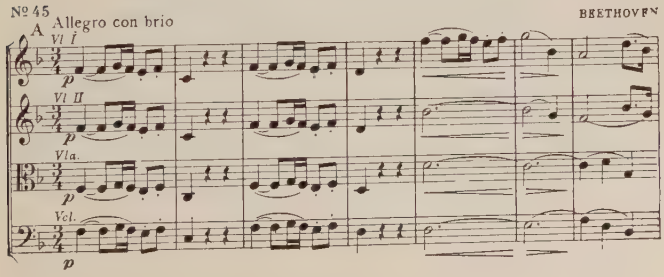
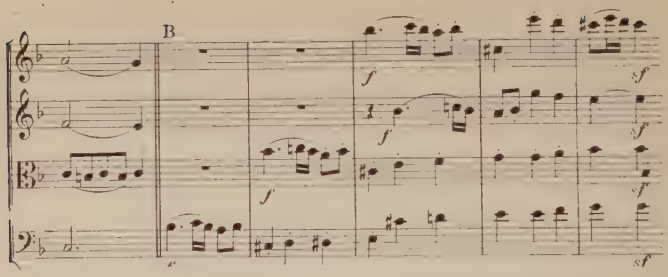
In referring to the Violin of Cremona as a perfect instrument, the term is not employed casually, but with a full realization of its import, for although many later instrument makers have labored conscientiously, and have sought to improve upon the old models, no vital betterments have been introduced, and the greatest claim that can be made in behalf of a given modern Violin is that it equals one of those fashioned by the old masters, which are ever in demand.

The high valuation placed upon these ancient instruments serves to emphasize the significance of the word "perfect," which we know is an adjective admitting of no comparison. When any feature or detail of a perfect work is altered or over-accented, a lack of proportion ensues, and it is no longer perfect. This is true not only of a work of art, but also of a style of architecture, poetry or music.

The String Quartet

Seeing that the Violin family possess the gift of *portamento*, employing the delicate transitions from

tone to tone which is possible to the human voice, many music lovers regard the string quartet as the ideal phase of abstract music. A discussion of this form belongs to the departments of Appreciation and History, but a word should be added at this point concerning the instrumental combination. There are two Violins, known as "First" and "Second" playing respectively the soprano and alto parts. The Viola furnishes the tenor and the 'Cello provides the bass. The spirit of the ideal quartet is through and through democratic. True, at times the melody is given to a Violin, the Viola or the 'Cello, while the others play subordinate parts, but the real essence of this type of work demands that each one shall have the right to discuss the various themes of the work. Note this attractive theme of Beethoven at the opening of his *F-major Quartet*, Op. 18. At first all take it up in unison for four measures (No. 45, A) then the First Violin elaborates it while the others add the harmony. A fragment of what is called the "development sec-



tion," (No. 45, B) shows how the same motive is played in turn by the 'Cello, Viola, First Violin and Second Violin.

CHAMBER MUSIC IN 1635
(*From Abraham Bosse*)

Questions for Review

1. What city is identified with the highest development of the Violin?
2. Mention the most celebrated makers.
3. Give a general description of the Violin, and how its strings are tuned.
4. How are the tones of the various scales produced?
5. Tell something of the *positions* in Violin playing.
6. What are *double stops*?
7. What are *harmonics*?
8. Give the signs for *up-bow* and *down-bow*.
9. What is a *tremolo*?
10. Explain *pizzicato*.
11. What is the meaning of *col legno*?
12. What is a *sordine*?
13. Describe the Viola and show how it is tuned.
14. What is its chief mission?
15. How is the Violoncello tuned?
16. Tell something of the character of its different strings.
17. Give the tuning of the strings of the Double Bass and explain their true pitch.
18. Describe the Viol d'Amour.
19. Tell something of the String Quartet and its place in musical art.
20. What is the meaning of *First* and *Second Violin* in concerted music?

References

Allen	Violin Making.
Abele	The Violin.
Engel	The Violin Family.
Hart	The Violin: Its Famous Makers.
Forsyth	Orchestration
Mason	The Orchestral Instruments and what they do
Sachs	Real-lexicon der Musikinstrumente.
Hamilton	Sound and Its Relation to Music.
Grove's Dictionary	*Articles*: Violin, Viola, Violoncello, Double Bass, Bowing, String, Violin Playing, Amati, Guarnieri, Stradivari, and biographical sketches of Violinists mentioned.

ILLUSTRATIVE RECORDS AND ROLLS

Records:

V—Victor; B—Brunswick; C—Columbia; E—Edison.

Rolls:

A—Ampico; D—Duo-Art; M—Melodee; Q—QRS.

Music Mentioned in Chapter VI

Beethoven—Egmont Overture V.
Beethoven—Fifth Symphony (*Andante con moto*) C, V; A, M. Q.
Rimsky-Korsakoff—Capriccio Espagnol C.
Rimsky-Korsakoff—Schererazade C, V; A, M.
Saint-Saëns—Danse Macabre C, V; A, Q.

SAINT-SAËNS—Suite Algerienne (*Allegretto*) V.

TCHAIKOVSKY—Fourth Symphony (*Scherzo*) Q, M.

TCHAIKOVSKY—Fifth Symphony (1st movement) V; Q, M.

TCHAIKOVSKY—Sixth Symphony (*Finale*) C, V; A, M, Q.

WAGNER—Introduction to Act III *Lohengrin* C

WAGNER—Overture to *Tannhäuser* C.

Chapter VII

WIND INSTRUMENTS

"Will you play upon this pipe? . . . . Govern these ventiges with your fingers and thumb, give it breath with your mouth, and it will discourse most excellent music."—*Shakespeare.*

IN treating of the types under the above heading it may be said that they are, broadly speaking, divided into two general classes, the Wood-wind and the Brass-wind. Seeing that the primitive forms of the various families have been touched upon in Chapter II, we shall confine ourselves to those more highly developed specimens that have found a permanent abiding place in the modern orchestra.

It should be stated, however, at this point, that while the distinctive expressions "wood" and "brass" obviously referred originally to the material of which the various instruments were constructed, these terms became generic in the course of time, so that, at the present day we find members of the wood group (Flute, Piccolo, etc.) occasionally fashioned from silver and even gold. But this affects neither their tone quality not classification.

Tone Color in the Orchestra

Whereas the Orientals employ their Wind and Percussion instruments chiefly as a means of increasing the quantity of sound in their bands, we of the Occident value such auxiliaries for more refined and aesthetic reasons. In listening to a conversation, additional interest is derived by observing the voices of the various speakers, each of which has an individual character. In like manner the significance of a symphonic theme is enhanced when we hear it uttered now by the Violins, then by the Oboe, and again by Clarinet, Flute, Horn, etc., each factor being recognized not by the quantity but by the quality of its tones.

The reason for the different tone qualities or tone colors which distinguish these instruments was vaguely apprehended over two centuries ago, but not until Helmholtz announced his theories was it known that they were due to the different combinations of the overtones accompanying the fundamental.* Especially pronounced are the tone colors of the wind group. Hence when it is entrusted with a long movement, it is less enjoyable than a similar passage for strings, for the latter can be more readily modified, not only in regard to dynamic shading but in tone quality.

*See Gehrkens' *Fundamentals of Music*, p. 168-169.

The Wood Wind

In order to obtain an idea of the distinctive characteristics to be discussed, it will be necessary for the student to refer to the table of Wind Instruments given in Chapter II, p. 35.

In group A "pipes with simple aperture," in subdivision b, will be found those that are "blown transversely." Among these will be observed the European representatives, *Flauto traverso* or Flute blown "cross wise" instead of straight out like the ancient Whistle Flute and Flageolet.

In group B "Pipes with reeds," the European type is the Oboe.

Since the Medieval Period a very valuable and distinguished family has been added to the orchestral aristocracy. This consists of the Clarinet and its kindred which produce their tones by means of a single "beating" reed.

The Function of the Keys

The Flute in common with all other members of the modern wood-wind group shows its kinship with the prototypical instruments of antiquity, inasmuch as it possesses the traditional series of holes that enables the performer to produce the diatonic scale. In order to obtain the sharps and flats (the tones that fill out the complete chromatic scale) other holes have been bored that are covered with pads controlled by keys.

The original Flute, Oboe, and English Horn gave the series of the *D-major* scale. Later other holes and keys were added giving lower tones. From the preceding we gain a general idea of how the scales are produced upon the modern wood-wind instruments and it will be well to bear in mind the following general principles:

A. The holes stopped by the fingers give the diatonic scale.

B. The keys are employed: (1) for the production of chromatic tones; (2) for the extension of the compass.

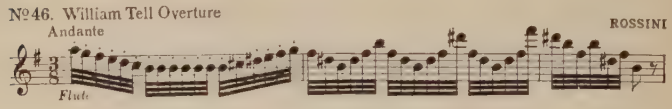
The Flute Family

(It. *Flauto;* Fr. *Flûte;* Ger. *Flöte.*)

By means of the keys just mentioned the Flute's compass has been extended downward by the addition of $\overline{c\sharp}$, and $\overline{c}$ and (rarely) b. Then by means of the system of overblowing described previously (see p. 33) the performer has at command a range of some three octaves. (See No. 6, p. 33.)

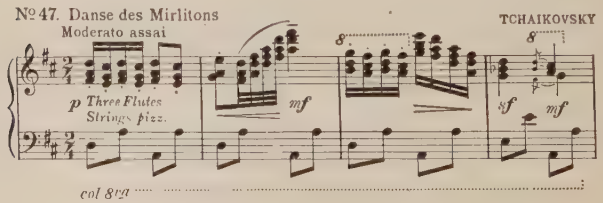
Whereas the old Flutes in common with other wood-wind instruments suffered from the disadvantage arising from boring the holes to fit the fingers regardless of faulty intonation which this precedure implied, at present, thanks to the new system introduced by Theobald Boehm (1832), purity of tone and greater flexibility of execution have resulted. The student will doubtless recall many Flute pas-

sages containing rapidly reiterated tones, scales, arpeggios and wide leaps such as we find in Beethoven's *Overture to Leonore No.* 3, Rossini's *William Tell Overture,* etc.



If we listen carefully to a performer slowly playing a scale throughout the entire compass of the Flute, we note that the tones of the lowest octave sound "hollow," those of the next octave are lyric and clear, while the upper register is sharper, the highest tones being quite shrill.

A pair of Flutes are often used with charming effect, as in the idyllic *Danse Grecque* quoted in the next chapter (p. 198).

The possibilities of a Flute trio in a light and airy measure are shown in the *Danse des Mirlitons* from Tchaikovsky's well known *Nutcracker Suite.*

The Bass Flute

(It. *Flautone;* Fr. *Flûte Alto;* Ger. *Altflöte.*)

For two centuries and more attempts have been made to extend the compass of the Flute family and bring it into line with the other wind groups, but the so-called Bass Flutes employed sporadically by Rimsky-Korsakoff and others descends only to small *g*, *f*, or possibly to *c* (below middle *c*), hence they have only the Alto or at most a Tenor register. Even these instruments require so much air that they fatigue the performer. The only bass tones with true Flute quality are those produced by the Organ, where the bellows supplies the air with ease. In this connection I venture to suggest, that, seeing the performer upon wind instruments in certain European orchestras have been furnished with bellows to ease their labors in the long or *fortissimo* passages, it seems as though true Bass Flutes with a compass of the Bassoon might be made with such bellows attached. This would complete the Flute family indeed,* although the low tones thus produced could never be as expressive as those of the Bass Clarinet or Horn. Efforts to extend the upper range of the

*Gevaert (1885) says "that as the Flute group lacks the masculine (lower) register it cannot be called a 'family.' "

Flute were more successful and resulted in the Little Flute (*Flauto Piccolo*).

The Piccolo

(It. *Flauto Piccolo or Ottavino*: Fr. *Petite Flûte*: Ger. *Kleine Flöte*.)

While the music written for this, the highest orchestral instrument, looks like that for the Flute, it sounds an *octave higher*. Its chief value is that it serves to supplement the Flute and lends the penetrating tones of its highest register to the orchestral mass in *ff*. In such cases its aid is invaluable, witness the numerous dramatic scenes in Wagner's works, *Ride of the Valkyries*, *Magic Fire Scene*, Overture to the *Flying Dutchman*, also the first movement in Tchaikovsky's *Symphonie Pathétique*. Occasionally the soft tones of the Piccolo are fittingly applied as in the third movement of the Symphony just mentioned, and in the curious bit from Rimsky-Korsakoff's *Coq d'Or* given in the next chapter, p. 206. But valuable as are its upper tones, the lower ones are weak and often absurd, so are usually avoided.

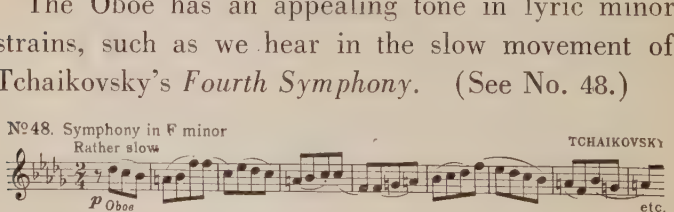
1. FLUTE 2. PICCOLO 3. BASS CLARINET 4. CLARINET
(Showing the relative sizes)

The Oboe Family

(Old Eng. *Hautboy;* It. *Oboe;* Fr. *Hautbois;* Ger. *Oboe.*)

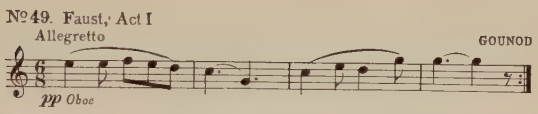
It will be remembered that the Oboe is an instrument with double reeds and is a lineal descendent of the Shawm (see p. 39). The compass of the modern Oboe for the average player is something over two octaves. The tones sound as written, always on the treble clef (see No. 48), but the instruments vary somewhat. Some years ago while I was in charge of the Yale Symphony Orchestra we gave one of Dvořák's *Slavic Dances* where three-lined *a* was demanded,* and had to be transferred to the Flute. Visiting the composer in Prague not long after, I asked him about this high *a*. He replied that his oboist produced it with ease. With this in mind, I was surprised not long after, on rehearsing a number from my *Ben Hur* music in London to find that the 1st oboist, a good player, told me his instrument would yield nothing above three-lined *c*.

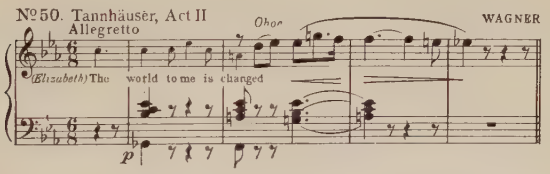
The Oboe has an appealing tone in lyric minor strains, such as we hear in the slow movement of Tchaikovsky's *Fourth Symphony*. (See No. 48.)



*See Gehrkens' *Fundamentals of Music*, p. 166, for the names of the octaves.

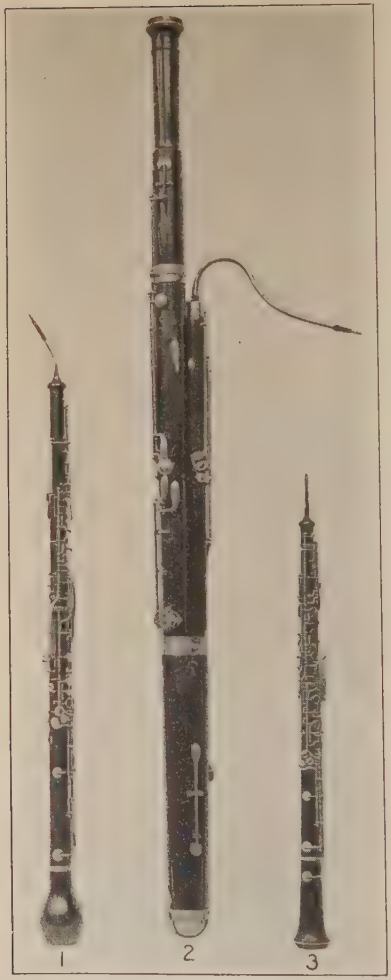
Again it suggests the joys of rural life, as in the opening chorus of Gounod's *Faust* (No. 49).



One of the most effective miniature motives is that which is heard given by the Oboe when Elizabeth meets her long absent lover in the second act of *Tannhäuser* (No. 50).

The English Horn

(It. *Corno Inglese;* Fr. *Cor Anglais;*
Ger. *Englisches Horn.*)

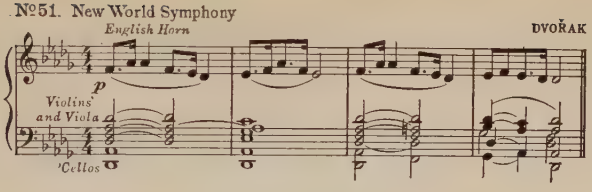
Why the contralto of the Oboe family should be called "English Horn" is a question that no one can definitely answer. It is specifically a melodial instrument of a pastoral character tinged with tenderness, we might say timidity. Its compass is practically that of the Oboe and is often played by the 2nd oboist who, however, while playing the notes (on the



1. ENGLISH HORN 2. BASSOON 3. OBOE
(Showing relative sizes)

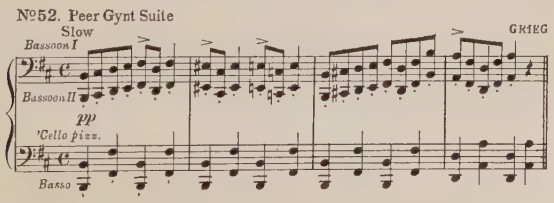
treble clef) written as if for the Oboe, produces tones that always sound a fifth lower.

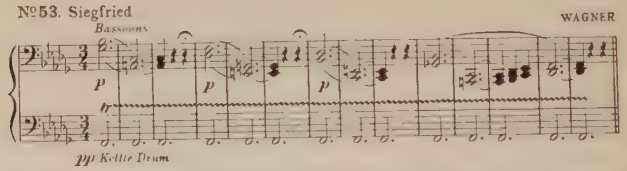
We here encounter for the first time the necessity for transposition, of which more later.* Schumann in his *Manfred Music* gives the melody of the Alpine shepherd's pipe to the English Horn. One of the instances of its employment in more recent music may be found in the Largo of Dvořák's *New World Symphony*, where it sings the plaintive lyric theme. (No. 51.)

*See p. 180.

The Bassoon

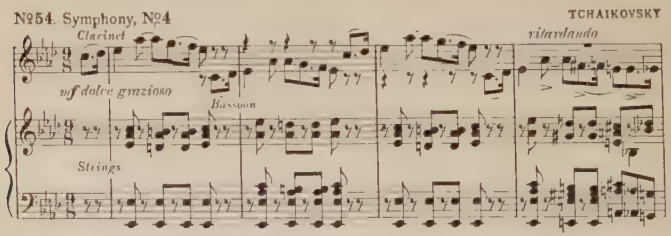
(It. *Fagotto;* Fr. *Basson;* Ger. *Fagott.*)

The Bassoon serves as the bass of the Oboe family. Its tube, being so long that it has to be doubled on itself, makes it look something like a fagot, hence the name given it in Italy and Germany. It is the descendent of the old Pommer Bass, the masculine member of the Shawm family (see p. 40). It has a compass of three octaves from contra *B*♭ to the one-lined *b*♭. Its part is written usually on the bass clef though the upper octave is often placed on the tenor clef (middle *c* on the 4th line) and the tones sound as written. In other words, it is called a non-transposing instrument.

There is a marked difference in the character of its various registers; the lowest is clumsy of enunciation and grotesque in tone, as in the opening measures of the last number of Grieg's *Peer Gynt Suite.*

Wagner whose genius for expressing all shades of moods and emotions was phenomenal, depicts the sly plotting of the dwarf Mime by means of the Bassoons accompanied only by a long murmer of the Kettle Drum (Great *F*) in the Prelude to *Siegfried.*



But the Bassoon is capable of uttering tones of pathos, as in the Finale of Tchaikovsky's *Symphonie Pathétique,* and even phrases of lyric beauty, such as we find in the first movement of that master's *F-minor Symphony* quoted in No. 54.



The Double Bassoon

(It. *Contrafagotto;* Fr. *Contre-Basson;* Ger. *Kontrafagott.*)

This valuable instrument possesses a compass similar to that of the Bassoon, minus the lower tones. Music for it is written on the bass clef, and like the

Double Bass sounds an *octave lower* than written. Its upper octaves are rarely used, for its mission is to supply those deep organ-like tones which, for example, give such resonance to the theme of Haydn in the Variations, Op. 56, by Brahms, and also in the final movements of the latter's *C minor Symphony*, Op. 68. Rapid passages are difficult to execute and I have been told by good players that "with all due respect to Beethoven, the runs he gives the Double Bassoon in his *Ninth Symphony* never come out well." Its solemn tones seemed fitted to express the bewilderment of the Dodo in *Alice's Adventures* so I hazarded the experiment of giving this instrument a solo part. Henry Hadley in his *Salomé*, has derived some wind effects from a combination of Bass Clarinet with Double Bassoon.

The Clarinet Family

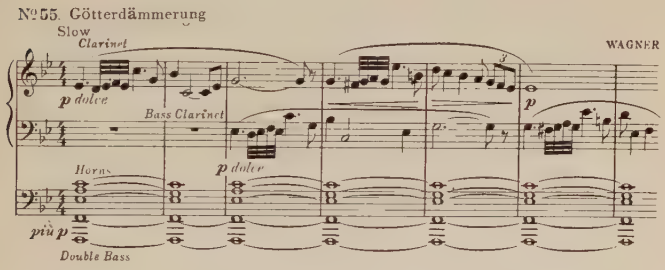
(It. *Clarino* or *Clarinetto;* Fr. *Clarinette;* Ger. *Klarinette.*)

The ancestor of the Clarinet was of French origin and called the *Chalumeau.* It consisted of a cylindrical pipe with nine sound-holes, the tone being produced by means of a *free-beating single reed.* It will be remembered that the Oboe family all have *double reeds.* But this primitive pipe (the *Chalumeau*) could only produce those nine tones in addition

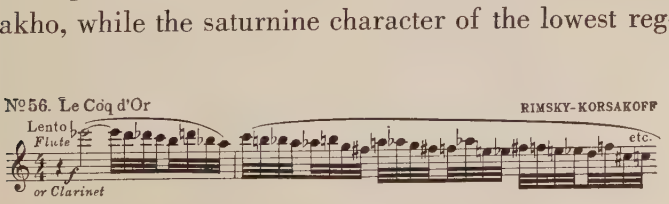
to the fundamental (sounded with all holes closed) for none could be produced by over-blowing, as in the case of Flute, Oboe, etc. At length, about 1700, a Nuremberg inventor devised what the English call a "speaker key" which enabled one to produce a similar series to the row of fundamentals by over-blowing. He also added a bell which improved the tone. But singularly enough the resulting tones were not an octave above the fundamental but a 12th. The reason for this is because conical tubes (Flutes, Oboes, etc.) overblow most readily in the octave or 2nd tone of the Harmonic series while instruments with cylindrical tubes never can give any but the uneven tones of the series (the 3rd, 5th, 7th, and 9th). It will be seen from the above, that there was still a gap of a minor third between the upper tone of the original series and the lowest of the second series. To fill this space, holes with keys were added. The compass was also extended below in the same manner, which explains why the Clarinet requires more keys than the Oboe and is much longer.

The newly acquired register resembled the sound of the Trumpet (It. *Clarino*) and was called *Clarinetto* (small Trumpet) which name it still retains while the ancestral title is also perpetuated in the designation of its lowest register, *Chalumeau* (Ger. *Schalmei*).

The Clarinet has two other registers, the middle and the highest. The middle lies in the "break" (as

in some voices) between the lowest and the highest and is weak and dull. The highest is rarely called upon except in *forte* passages. That the middle register may be touched softly without injuring a phrase, may be seen in the lovely theme of Brünnhilde's wifely devotion from the first act of the *Götterdämmerung* (No. 55).

A curiously beautiful lyric duo between Clarinet and Bassoon is to be found in the first movement of Tchaikovsky's *F-minor Symphony.* (See No. 54.)

A good illustration of what can be done in the highest register is shown in the bit from the Prelude to Rimsky-Korsakoff's *Coq d'Or* where the Clarinet anticipates the wondrous air of the Queen of Chimakho, while the saturnine character of the lowest reg-



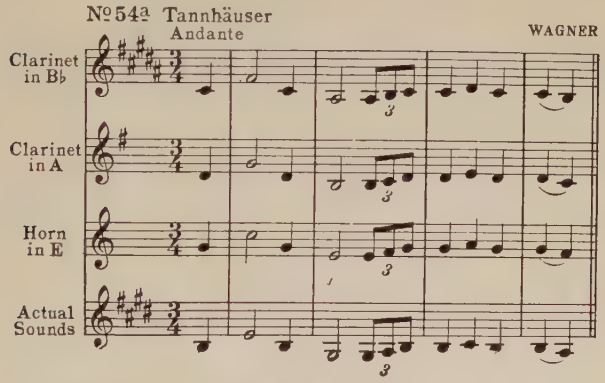
ister was shown by Weber in the Incantation Scene in *Der Freischütz.*

Transposition

It is obvious that where the mechanism is so complex, the nearer one keeps to the typical key *C-major* (*A-minor*) the easier is the execution. For this reason the Clarinets have been constructed in a variety of keys. Thus a Clarinet in *B♭* will give the tones of that scale, while the performer applies the fingering of the *C* scale. A Clarinet in *A* will give the *A* series when the *C* scale is played. This involves transposition again, therefore when employing the *B♭* instrument which puts all written notes a tone *lower* we have to write a given passage a tone *higher* to balance matters. For an *A* Clarinet which throws everything a minor third *lower* we write a minor third *higher*. These are the types most in use; especially favored is that in *B♭*.

Doubtless this may seem complex to the uninitiated but the reading of any orchestral score is impossible without mastering this problem of transposition. The following cut (No. 54a) illustrates the subject and shows that the Clarinet in *A* is far better adapted to the rendering of the opening phrase of the *Tann-*

häuser Overture than the Clarinet in *B*♭, which must employ so many tones foreign to *C*, the typical key. It also shows that the *b*♮ for the Piano must be written as *g* for the *E* Horn, *d* for the *A* Clarinet, and *c*♯ for the *B*♭ Clarinet.*



Clarinets in *D* and *E*♭ sounding respectively a whole tone or minor third higher are also still employed, in which case the music must be written a whole tone or a minor third *lower* to create the balance.

The Bass Clarinet

(It. *Clarinetto basso or Clarone;* Fr. *Clarinette basse;* Ger. *Klarinette.*)

The compass of this, the most expressive of all

*A California friend told of a mountaineer whose clock was a riddle to the neighbors. He said, however, that it kept good time for he was certain that when the hands pointed to half-past three and the clock struck five, it was a quarter to six. In like manner the note *C* sounded on the *A* Clarinet is the same as *F* on the *E* Horn; and *G*♯ on the Piano is the same as *A*♯ on the *B*♭ Clarinet and *B* on the Clarinet in *A*. (No. 54a shows this.)

deep wood-wind instruments, is like that of the Clarinet in *B♭* or *A* with its upper register shortened. Its notation is the same as for the ordinary Clarinet, sounding an octave lower than that instrument. Wagner, it is true, when writing for it employed the bass clef, the notes sounding a whole tone, or a minor third lower, according to the instrument employed, *B♭* or *A*.

It is capable of great dramatic expression and can utter its lowest tones with such delicacy as to be almost inaudible. For the reason that it is difficult for the Bassoon to give a Piano in this register, the pianissimo cadenza assigned it in the first movement of Tchaikovsky's *Symphonie Pathétique* is always transferred to the Bass Clarinet. Note its employment in No. 55.

The Brass-Wind

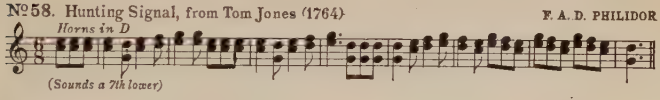
The student is asked to refer once more to the table given in Chapter II under division *C* and among the instruments with cup mouthpieces he will find the Horns and Trumpets described as "simple tubes without apertures." Such tones as these instruments could yield, were found to be the series of the Nature Scale or Harmonic Series only (see p. 47).

The Horn

(It. *Corno;* Fr. *Cor;* Ger. *Waldhorn.*)

When the Horns were first employed in the oper-

atic orchestra, they were regarded doubtless as justifiable "local color," as are the Trumpets, Harps, Bells, etc. on the stage at the present day, adding a touch of realism. One is led to this belief when he reads that the following "Hallali" or hunting signal



was introduced by the French composer Philidor in his opera *Tom Jones* in 1764 (a few years after the appearance of the novel of that name) and that the same motive was later used by Grétry and by Haydn in *The Seasons*. Although some of the auditors regarded these noisy factors as barbarous, the public gradually became reconciled and they obtained a regular position in the orchestra of the opera, symphony and oratorio.

But stereotyped Horn formulas with but two chords, tonic and dominant, were found to be monotonous when unenriched by other rhythmic and harmonic devices. So performers and inventors sought to increase the tone vocabulary of the Horn and Trumpet group.

Horn Crooks

The limited number of tones producible upon the ancient and medieval Horns necessitated some means of varying the pitch when the key of a piece

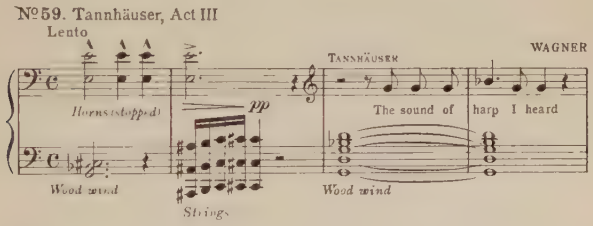
was changed. This was effected by inserting in the main tube of the Horn, smaller tubes called *Crooks*. These crooks so lengthened or shortened the main tube that the pitch was lowered or raised to any desired key. Hence we find constant allusions to Horns in *C*, Horns in *F*, Horns in *B♭*, *E♭*, *G*, etc. As the only means of producing the various tones of the Nature series was by overblowing or by modifying the pitch with the hand, the performer always played the same notes although they sounded in different tonalities. Here again we come upon the necessity of *transposition*. But players and conductors soon became accustomed to a given routine.*

Stopped Tones

It has been shown on page 47 that the 7th, 11th, 13th and 14th tones of the harmonic series did not coincide with any in the tempered scale. In order to make these unruly members of the series bearable, a means of modifying them was applied called "stopping." This consisted in thrusting the player's hand into the bell of his instrument lowering the pitch so that in the scale on page 47 the 7th (just too low for *B♭*) became a very good *A*, the 11th (too low for an *F♯*) became a good *F♮*, etc. However, these stopped tones were never so bright and brilliant as the natural open

*Some years ago I saw the score of Max von Schillings' *Moloch* wherein every instrument was written as it sounded but instead of being easier to read, such is habit, the effort was quite puzzling.

tones, but by blowing *forte,* while generating these stopped tones, a new and strikingly dramatic effect was obtained.

When in the third act of *Tannhäuser* the hero is seen returning from his fruitless pilgrimage to Rome, the motive of the Pope's curse is heard given by stopped Horns with insistent vehemence.

This device has been applied to other instruments. Wagner employs a stopped Trumpet in the third act of *Die Meistersinger* to imitate the little trumpets of the toy makers. In this case the stopping is not produced through the agency of the hand, but by inserting in the bell of the Trumpet a pear-shaped *mute.*

When planning the music to *Macbeth,* I sought some legitimate means of suggesting the blare of the ancient Scottish War Horns, and tried the experiment of thus stopping or muting the Trombones, which were played *ff.* Since then I have noticed that Strauss, and others place mutes on all brass instruments. At the present day this device is much abused. In a conversation with Reginald DeKoven

on the subject he remarked that "Many composers seem to apply the rule 'When in doubt, use *stopped horns.*' "

The Mystery of the Chromatic Horns

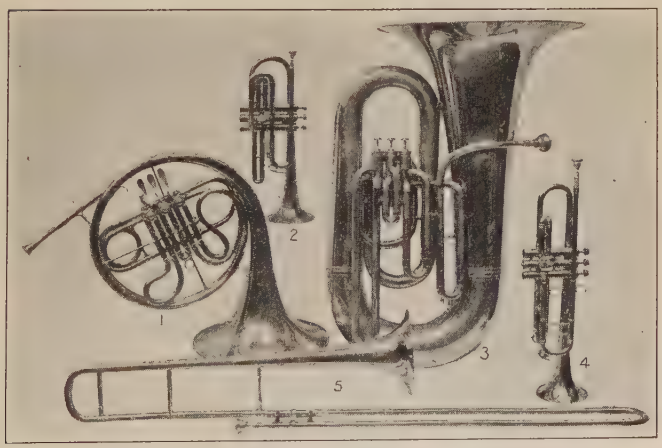
(It. *Corno Ventile;* Fr. *Cor-à-pistons;* Ger. *Ventilhorn.*)

The thoughful amateur after listening to the flourishes of a modern cornetist takes up the instrument and contemplates it with a certain amount of awe, and wonders how all the diatonic and chromatic passages can be produced with the aid of only three keys.

It was shown in a former chapter how upon the simple natural Trumpet or Horn by means of the systems known as overblowing, the tones of the Nature series could be elicited (see page 48). Many were the attempts to extend the range and widen the scope of these instruments, in order to furnish the upper octaves of the brass group, for which the Trombones had already provided so rich a vocabulary. The most successful of these experiments culminated in the Zincke family. But these instruments proved too severe a strain upon the lungs of the performers and were gradually abandoned. It was not until early in the nineteenth century that the much desired chromatic Trumpet and Horn were perfected.

One of the earliest attempts in this direction consisted in a cluster of tubes, so grouped that they could be blown through a single mouthpiece and, by means of *keys*, the wind could be directed through any given tube at pleasure. As each tube represented a Horn in a different tonality, the various tones of the chromatic scale were produced.*

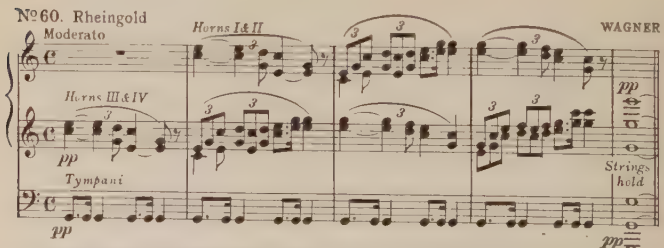
But a great improvement was soon afterwards devised. This consisted in connecting the tube of a Horn with three smaller lengthening tubes, each of which was controlled by a valve and key and by this means the performer obtained over three octaves of chromatic tones.

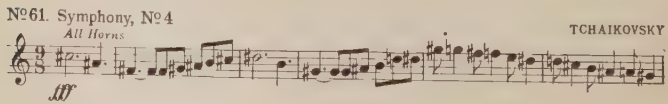


1. FRENCH HORN 2. CORNET 3. BASS TUBA
4. TRUMPET 5. TROMBONE
(Showing their relative sizes)

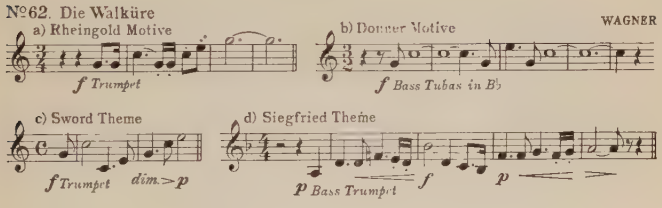
*A specimen of this instrument is in the collection at the Royal (now State) High School of Music at Berlin.

Thus although many improvements to insure purity of intonation were necessary, this remarkable achievement not only revolutionized Horn playing, but the principles of the valve were applied to the Trumpet and even to the bass brass instrument known as the Tuba.

It is interesting to observe how even with all the chromatic series at command Wagner and other modern writers give the Horns new and beautiful themes, which, however, follow the outlines of the old formula. Such a theme is that which accompanies the re-entrance of the Love Goddess Freia in *Rheingold*, Scene IV.

The Horns sound an 8va lower. Originally written for F Horns but transposed here to C, to show relationship to the traditional Horn formula.

Tchaikovsky, on the other hand, in his *Fourth Symphony* (1st movement) shows surprising daring in the use of chromatic tones.

The Valve Trumpet

(It. *Tromba ventile;* Fr. *Trompette-à-pistons,* Ger. *Ventiltrompete.*)

An easy way of visualizing the compass of the Valve Trumpet, is to think of it as being an octave higher than the Valve Horn in F. It produces, like that instrument, all the tones of the chromatic scale. Here, too, the influence of the old formula may be seen even in the original and striking themes of Wagner's *Nibelungen Trilogy.*

The Cornet-à-Piston

As the tube of the Cornet is half the length required by the Trumpet, its tones are an octave higher. For this reason the higher tones of the harmonic series are more easily produced upon the Cornet than by means of the Trumpet. The tones of the former are far less noble than those of the latter but its flexibility has made it popular and it is of great value in the military bands. While it should not be used to replace the Trumpet in the symphony and opera, the Cornet is sometimes used simultaneously

with Trumpets in serious works of the French and Russian composers, see Berlioz, *Harold in Italy* and Tchaikovsky's *Overture, 1812.*

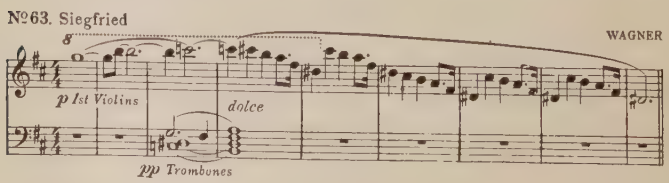
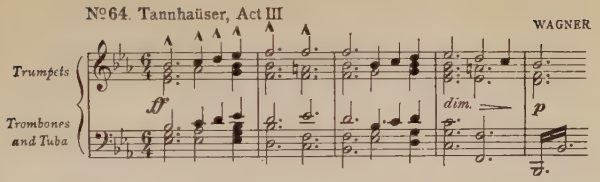
The Trombone

(It. *Trombone;* Fr. *Trombone;* Ger. *Posaune*)

This noble instrument whose relationship to the Sackbut has been shown in Chapter II was the only brass instrument capable of producing all the tones of the chromatic scale. But the classical composers rarely took advantage of this fact, and not until Schubert's time were its manifold possibilities exploited.

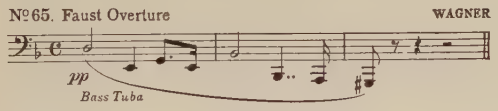
In the traditional employment of the Trombone in a group of three (two tenor and one bass), the former are written on the tenor, the latter on the bass clef, though for convenience they are sometimes combined on one or the other, according to the register required.

The Trombone has a vast dynamic range from the *pianissimo* in the scene where Siegfried climbs the rocks to find Brünnhilde to the glorious *fortissimo* outburst (combined with Trumpets) when Tannhäuser tells of the pardoning of sinners by the Pope.



Bass Tuba

The Ophicleide, or Bass Bugle described in Chapter II has, thanks to the invention of valves, been replaced by the Tuba. Its practicable compass is shown in No. 68, and a characteristic theme given it by Wagner in his Overture to *Faust*.



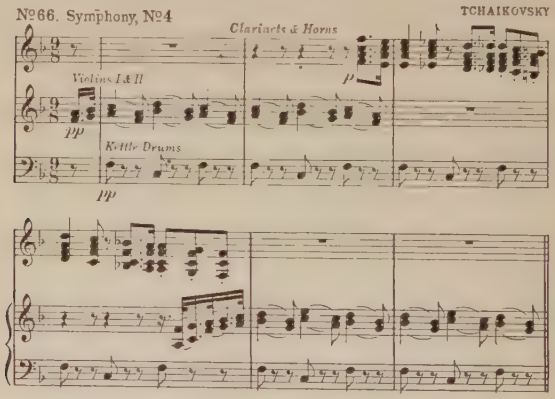
Kettle Drums or Timpani

(It. *Timpani;* Fr. *Timbales;* Ger. *Pauken*)

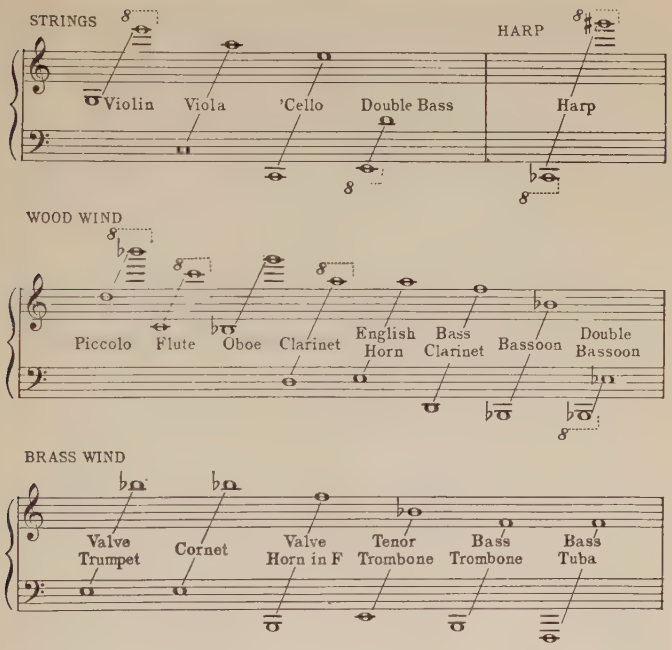
The only percussion instruments admitted within the precincts of the classical Symphony Orchestra were the Kettle Drums. They were long tuned as in the Orient to Tonic and Dominant, but Beethoven broke the spell and used other combinations.

Weber in *Der Freischütz* and Wagner in *Siegfried* did likewise, and since then in modern scores we find all sorts of experiments.

One of the most beautiful uses to which the Kettle Drums have been applied is the solo bass to the har-

monies of Violins—answered by the soft Winds, in the first movement of Tchaikovsky's *Fourth Symphony*.

Some writers divide the wind instruments into two general groups according to the strength of their tones. The *soft* wood-wind includes the Flute and Clarinet families, while the Oboe and Bassoon families constitute the *hard* wood-wind. The Horns are referred to as *soft* brass, the Trumpets and Trombones being the *hard* brass.

The following table shows the compass of the principal instruments of the symphony orchestra of today. It gives the actual pitch of each instrument and the usual range, though in solo work this is often extended.

№68 COMPASS OF ORCHESTRAL INSTRUMENTS
(Showing the actual pitch and range for orchestral purposes)

Questions for Review

1. What are the two divisions of Wind Instruments used in the modern orchestra?
2. Mention the chief families of the Wood Wind.
3. By what means are the diatonic scales produced upon the Flute or Oboe?
4. How are the chromatic tones obtained?
5. What is the average compass of the Flute?
6. By whom was the Flute greatly improved?

7. What is a Piccolo?
8. Name the chief members of the Oboe family.
9. Describe the quality of tone of the Oboe.
10. Give the compass of the Bassoon.
11. What of its tone quality in its different registers?
12. What is the chief difference between the Oboe and the Clarinet.
13. When was the Clarinet first introduced?
14. What was the chief difficulty in producing a continuous scale upon this instrument?
15. Mention the different members of the family.
16. Indicate some of the tones possible to produce on the Natural Horn.
17. What was the object of adding *crooks?*
18. What are stopped tones?
19. What invention made the chromatic tones feasible upon the Horn?
20. What effect did this exert upon musical composition?
21. Tell something of the Valve Trumpet.
22. What is the Cornet à Piston?
23. Describe the Trombone and its method of tone production.
24. Compare the Tuba with the Ophicleide.
25. Describe the Kettle Drums and their mission.

References

Hamilton	Sound and its Relation to Music, Chapter IX.
Lavignac	Music and Musicians.
Gevaert	Traité d' instrumentation
Rimsky-Korsakov	Instrumentation.
Prout	The Orchestra.

FORSYTH	Orchestration.
BERLIOZ	Treatise on Modern Instrumentation.
WIDOR	Technique of the Modern Orchestra.
WOODS	School Orchestras and Bands, Chapter XV on *Transposition.*
HENDERSON	The Orchestra and Orchestra Instruments.
MASON	The Orchestral Instruments and what they do.
SINGLETON	The Orchestra and its Instruments.
GROVE'S DICTIONARY	*Articles*: Flute, Piccolo, Oboe, English Horn, Clarinet, Bass Clarinet, Bassoon, Horn, Trumpet, Cornet, Trombone, Tuba.

ILLUSTRATIVE RECORDS AND ROLLS

Records:

B—Brunswick; C—Columbia; E—Edison; V—Victor.

Rolls:

A—Ampico; D—Duo-Art; M—Melodee; Q—QRS.
W—Welte-Mignon.

MUSIC MENTIONED IN CHAPTER VII

BEETHOVEN—Leonore Overture, No. 3 V; Q.

BEETHOVEN—Symphony No. 9, in *D-minor* M, Q.

BRAHMS—Symphony No. 1, in *C-minor* (*Last movement*) C; M, Q.

DVOŘÁK—Largo, Symphony No. 6 (*From the New World*) C, E, V; A, D, Q.

DVOŘÁK—Slavic Dances C; Q, W.

GRIEG—Hall of the Mountain King (*Peer Gynt Suite, No.* 4) C, E, V; A, D, M, Q, W.

ROSSINI—Overture, *William Tell* B, C, V; A, D, M, Q, W.

TCHAIKOVSKY—Danse des Mirlitons (*Nutcracker Suite*) E, V; D, M, Q, W.

TCHAIKOVSKY—Symphony No. 4, in *F-minor* (*First and second movements*) C; M, Q.

TCHAIKOVSKY—Overture, 1812 M, Q.

TCHAIKOVSKY—Symphony No. 6, in *B-minor* (*Pathétique*) (*First movement*) C, V; A, M, Q.

WAGNER—Magic Fire Scene (*Die Walküre*) C, V; A, D, M, Q, W.

WAGNER—Overture, *Flying Dutchman* A, Q.

WAGNER—Overture, *Tannhäuser* C, V; A, M.

WAGNER—Ride of the Valkyries (*Die Walküre*) C, V; M, Q.

INSTRUMENTS MENTIONED

Piccolo, BERLIOZ—Will-o'-the-Wisp (*Damnation of Faust*) V.

Flute, MOZART—Concerto for Flute and Harp V.

Oboe, BERLIOZ—Carnival Romain V.

Oboe, SCHUMANN—Romances for Oboe V.

Clarinet, OFFENBACH—Overture, *Orpheus* V.

Bassoon, SCHUMANN—Scherzo, Third Symphony V.

French Horn, WAGNER—Siegfried's Horn Call (*Siegfried, Act II*) V.

English Horn, HANDEL—Pastoral from *The Messiah* V.

Valve Trumpet, SAINT-SAËNS—Marche Militaire V.

Cornet, ELGAR—Pomp and Circumstance V.

Trombone, RUBINSTEIN—Torchlight Dance V.

Trombone, WAGNER—Prelude to Act III, *Lohengrin* V.

Bass Tuba, WAGNER—Dragon Motive (*Siegfried*) V.

Kettle Drums, BEETHOVEN—Eroica Symphony (*Third movement*) V.

Chapter VIII

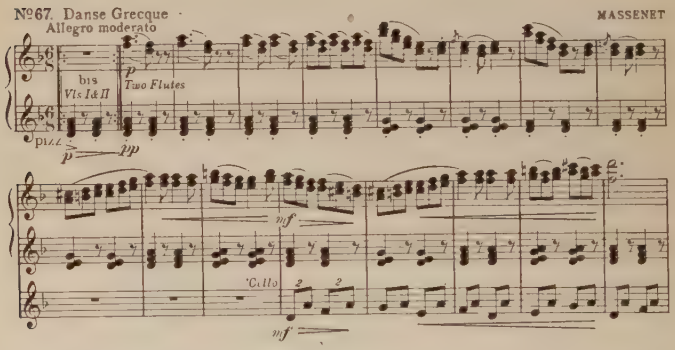
THE MODERN ORCHESTRA

"Music, of all the liberal arts, has the greatest influence over the passions, and is that to which the legislators ought to give the greatest encouragement."—*Napoleon.*

"Music was regarded by the ancients as a refined art, although it has since become a commerce."
—*Burton's Anatomy of Melancholy.*

THE performer upon his chosen instrument finds his pleasure increased when he can share it with others, and if competent companions join in the music-making this delight is still further enhanced. The social element is ever a strong factor in promoting the joys of feasting and dancing. It also intensifies the solemnity of funeral and other religious rites. If then the tones of Pipe and Tabor, Harp and Psaltery be added, the participants experience an exhilaration transporting them far beyond the affairs of everyday life. In this exalted realm we find the fountainhead of Art.

One of the most charming suggestions of ancient concerted music is the *Danse Grecque* from Massenet's *Les Erinnyes* wherein one seems to hear the

strains of the Greek Double-Aulos* accompanied by Lyres. The mood is intensified by phrases conceived in the Greek diatonic idiom and it requires but little imagination to picture dancing maidens in a

Hellenic forest with a Doric temple in the distance. And all this with but two flutes and strings.

However, we must not forget that while the modern instruments here employed are related to those of antiquity this excerpt possesses a charm lacking in the music of all countries and all periods excepting those of relatively modern Europe, namely Harmony. And here be it once more stated with renewed emphasis that while we owe to the Orient the original types of most, if not all, of those tone-producing media employed in our modern music, it was in Europe, in connection with the Christian Church, that the art of *part singing* was developed and the parallel art of *part*

*See Chapter II, p. 32, for illustration of the Greek Aulos.

playing was subsequently elaborated. This involved the construction of instruments with bass tones of similar quality to that of the upper register. These instruments with adequate bass together with the polyphonic music they rendered possible distinguish the European Art of Tones from all other music.

Orchestra of the 11th Century.

Orchestral Homogeneity

The bands one hears in the Chinese theatres are chiefly noted for the din they create, the soft tones of Flutes and strings being drowned by the brass and percussion. This predominance of the noisier members was also noticeable in European orchestras when Trumpets and Horns were first introduced. In order to create a balance of power between the orchestral groups it was found necessary to resort to "doubling" or rather multiplying the number of performers in the string group. The proper proportion of strings to wind instruments according to Gevaert is three of the former to one of the latter. Thus in an orchestra adapted to the Mozart symphonies there should be

thirty strings, divided thus: 8 First Violins, 8 Second Violins, 5 Violas, 5 'Cellos, 4 Basses. This should balance 2 Flutes, 2 Oboes, 2 Bassoons, 2 Horns, 2 Trumpets. A Beethoven symphony would require an addition of 2 clarinets, 2 extra Horns and Kettle Drums with 12 more strings, 57 to 60 in all.

Since the time of Meyerbeer, Berlioz and Wagner, the brass group has so grown in importance that to give their works with well proportioned forces an orchestra of from 90 to 110 is requisite.*

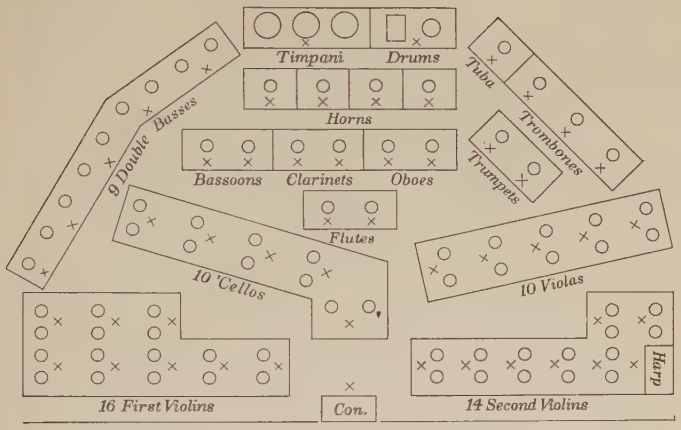
This general average is sought even in the "Monster Concerts" where orchestras of two or more hundred are involved. Even in the great International Peace Jubilee at Boston in June 1872, when there were 2,000 in the orchestra and 20,000 in the chorus, the above mentioned proportions were approximately attained by Mr. P. S. Gilmore, the conductor.

Position of the Performers

In seating the musicians of the orchestra the ideal sought to give those with the lesser tone an opportunity to be heard to the best advantage. Thus it is that the Violins are placed in the front, the Violas and 'Cellos immediately back of them, then the

*This doubling of the strings is not always thoroughly grasped by the layman. The writer was once told by an ardent patron of a Western symphony society, that their conductor performed on all the instruments in the orchestra. "Think of that" said the enthusiast, "he plays seventy-five instruments—seventy-five instruments!"

wood-wind while the brass and percussion fill in the rear—somewhat after the manner shown in the accompanying diagram.



A Symphony Orchestra of eighty performers.

The Conductor

To enable a group of singers or performers to keep together, it was early found necessary to indicate the accented notes. This usually took the form of beating time, a practice known among savage tribes as well as among more cultured people of antiquity.

At the present day this function is entrusted to the conductor who usually stands in front of the performers with his back to the audience holding in his hand the all important baton with which he gives his signals. Upon his shoulders rests the responsi-

bility, not only of enforcing a unanimity of execution but it is also his duty to carry out the intentions of the composer. Sometimes he is obliged to make certain alterations in order that the effect desired by the composer may be obtained.

Since the invention of Valve-Horns and Trumpets it has become possible to render upon those instruments passages which earlier composers would have most earnestly wished performed on Horns or Trumpets, but because of the limitations of the old instruments they were forced to use the less effective woodwind. In such cases both composer and the listener are benefited. On the other hand, the conductor can do much damage not only through unjustified alterations of the score, but by means of exaggerating the tempo or the dynamics so that the composer's intentions are wholly distorted.

As mentioned in the first volume of this Course of Study,* the interpretation lies chiefly with the conductor who can make or break the work in question. In listening to the Tchaikovsky *Symphonie Pathétique* (referred to in this passage) conducted by a rival composer, it was obvious that he was not interested, neither was his audience, as he rendered it; whereas later under a sympathetic leader it produced a marvelous impression.

Again, the impressive opening measures of

*Gehrkens' *Fundamentals of Music*, p. 180-181.

Brahms's *C Minor Symphony*, where the steady strokes of the Kettle Drums given in the proper tempo seem like the strides of a giant after a given goal, are sometimes performed in such increased speed that they suggest the mincing gait of an affected spinster.

Some composers dread listening to their own works, anticipating unpleasant alterations. MacDowell once told us that he never went to hear any of his compositions for they were rarely done in the way he conceived them.

Instruments Outside the Symphonic Group

While the two preceding chapters have been chiefly devoted to the instruments peculiar to the symphony orchestra with brief mention of those heard in certain operas, we must not ignore altogether that class occasionally introduced for special efforts and designated by Rimsky-Korsakoff as the "ornamental instruments."

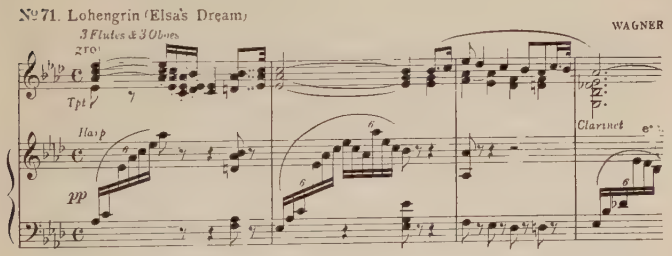
In this category we must place those stringed instruments described in Chapter III, the Harp, Lute, Mandolin and Guitar. To these must be added the non-symphonic percussion (*a*) with definite pitch, Glockenspiel and other bell imitating devices, then the Celesta and Xylophone and finally (*b*) those agents producing indefinite pitch, the various Drums, Cymbals, Triangles, etc.

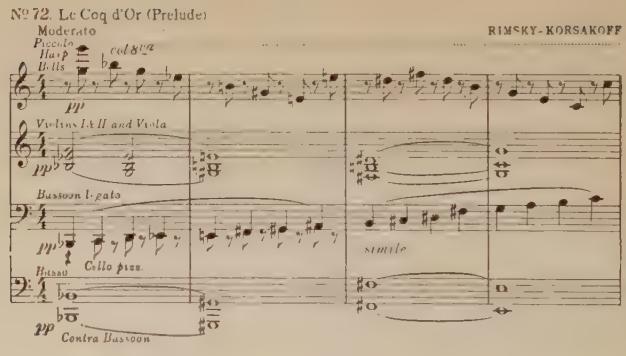
The Harp

This ancient instrument now has a compass of 6½ octaves (See Chapter III). During the last century and more it has received very material improvements, the most vital being the system of pedals introduced by Erard, the Parisian Pianoforte and Harp manufacturer, about 1802. By means of this system the instrument may be adjusted so that it gives the tones of any scale. Thus, when in its normal position, its strings yield the series of the diatonic scale of *C♭ major*. There is a pedal for each of the seven tones, and each pedal is provided with two notches enabling the performer to raise any given tone a half or a whole tone. For instance, the *C* pedal raised to the first notch changes all of the

Modern Pedal Harp

C flats to *C naturals*. If it be raised to the second notch all these *C naturals* are transformed into *C sharps*. The typical Harp figures are such as we term in Piano music *arpeggios* (It. *arpa—Harp*).

In spite of these modernizations it has lost nothing of its superterrestrial character which is nowhere more significantly shown than by Wagner in *Lohengrin*. One of the many familiar instances that might be cited is where Elsa in the opening scene relates her vision of the Knight who shall come to prove her innocent in the impending trial.

Not only is the Harp a valuable accessory when used as above, and in kindred arpeggio figures, but when treated as one of a tone group it assists in producing special efforts. Its prickly upper tones combine with the delicate staccato of Piccolo and Celesta are employed by Rimsky-Korsakoff to suggest the angular gestures of the quaint old Astrologer passing across the stage in front of the curtain in the Prelude to *Coq d'Or*.



The Lute

Like the Mandolin and Guitar which lend local color to scenes in the Operas of Italian and other composers the Lute has been introduced by Wagner with marvelous effect in *Die Meistersinger.* Not merely because of its peculiar tones that accompany the Serenade of the self-satisfied Beckmesser (which sometimes degenerates into burlesque), but the unpromising formula afforded by the tuning of the Lute with its parallel 4ths, was elaborated by Wagner into one of the most remarkable fugues ever conceived.* The workmanship is all the more noteworthy as it grows along with the action on the stage.

Bells

Bells, too, at their best as already suggested pos-

*The technical term for this number is *Fugue with Chorale*, the Serenade of Beckmesser being used line by line after Bach's manner in his choral fugues.

sess a rare spiritual nature. 'Tis the semblance of dimly remembered bell tones calling a prayer that first invites the erring Tannhäuser to return from a voluptuous existence to a life of devotion to high ideals.

Observe the beautiful downward progression of every changing harmony that give variety to the otherwise monotonous repetition of the tone *E* and *B*. Those familiar with the Opera will realize the artistic refinement shown by Wagner in merely suggesting these bells with the delicate Flute and Oboe tones, instead of using the Glockenspiel or some similar device. Again how valuable is this restraint when we hear in the very next scene the tinkling of genuine sheepbells emphasizing the reality of the world to which Tannhäuser has returned.

Small bells have been used with excellent success in *Fra Diavolo*, *Lakmé* and other operas. But when it comes to imitating the thunderous peals of the bells of church or monastery—that is a problem. As an instance, the deep bass-tones demanded by Wagner for *Parsifal* have long troubled stage managers, and various experiments have been tried in order to obtain the desired results.

The Glockenspiel

The Glockenspiel or "Bell-play" is a series of steel bars arranged like the keyboard of the Pianoforte

and struck with metallic hammers, one held in each hand of the performer. The tone is piquant and when employed at the proper moment is charming and even exhilarating. Wagner has introduced it with a skill as refined as it is reserved. It gives emphasis to the tones of the Toy Trumpet effect in excerpt No. 38, p. 146, while in the *Magic Fire Scene* No. 74, p. 223, it mingles finely with the flickering of the flames simulated by Violins and Wood-wind.

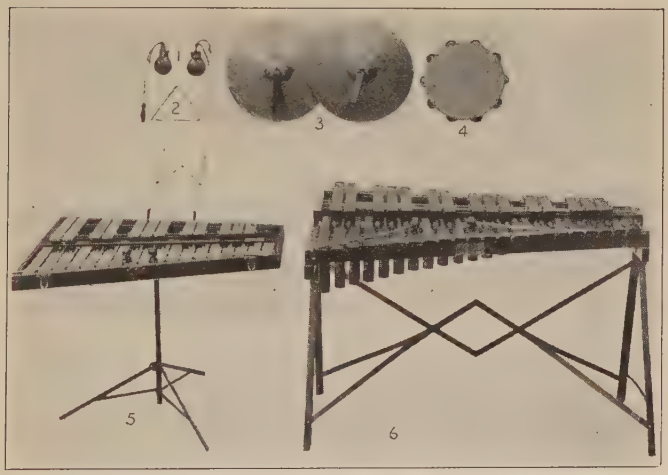
The Xylophone

This factor described in Chapter I, page 24, although long known in European as well as in uncivilized countries, first came into prominence in 1876, through its introduction by Saint-Saëns in his remarkably vivid symphonic poem *Danse Macabre*. The startling suggestion of the rattling of skeleton bones shocked many, but the work has held its own, not because of its bizarre effect but by virtue of the originality of its themes, harmonies, contrapuntal devices and orchestration.

Celesta

This is a comparatively recent tint added to the orchestral palette. It consists of a series of steel

bars struck with hammers operated by keys like those of a piano and played in the same manner. It was first introduced by Tchaikovsky in his *Nutcracker Suite*.



1. Castagnets 2. Triangle 3. Cymbals 4. Tambourine
5. Glockenspiel 6. Xylophone
(Showing their relative sizes)

The Non-symphonic Percussion

It is indeed deplorable that the instruments falling under the caption "Percussion" should be regarded by the unthinking as the rag-tag and bobtail of our orchestral forces. True, the sensationalism of our vaudeville and theatrical bands with their Pop-guns, Sleigh Bells, Crickets, Kazoos, Sandpaper, Glissando-Whistles and other noise generators may lead the layman to regard musical art as a joke and orchestra-

tion a farce. Unfortunately composers of high rank have sometimes paid little attention to the expression marks in the parts for the worthy Kettle Drums. This scant courtesy has led to a carelessness on the part of many conductors who permit these classical percussionists to drown with their *fortissimos* the tones of the strings, the wood, the brass, indeed the entire orchestra, leaving the audience in doubt as to the composer's intentions. But, on the other hand, some of the wittiest, most delicate and refined effects have been produced by an unusual application of this much abused class of instruments, not only in such lovely bits as (No. 66) but in scenes from *Fidelio* and *Der Freischütz.*

Drums With Indefinite Tone

These instruments having been touched upon in Chapter II, a few words may be added to their present day employment. The great or Bass Drum, as it is popularly termed, is not always used for its noise, as in the storm in the *William Tell* Overture or for heavy accents in marches and the like, but when used pianissimo it suggests the mystery of the Orient,—as in the entrance of the Mikado in Sullivan's Opera of that name.

The side or Snare Drum is so inevitably connected with the Fife or with Brass and Military Bands

that one rarely thinks of its finer possibilities. And yet Wagner has used it with thrilling effect in the great *Chorus of Nobles* in Act II of *Die Götterdämmerung*, where its roll from *pp* to *ff* accompanies the cries of devotion to King Gunther.

1. Kettle Drum 2. Snare Drum 3. Bass Drum
(Showing their relative sizes)

The smaller Hand Drum, Tambourine or the similar *Tambour de Basque*, is used in three different ways (1) struck with the knuckles on the parchment, (2) shaken so that the little jingles rattle, (3) rubbed across the parchment with the moistened finger or thumb, producing a delicate trilling of the jingles. The last method is that employed in the lovely *Danse Arabe* in Tchaikovsky's *Nutcracker Suite*.

The Cymbals

These also have been mentioned in Chapter II. They are in the minds of many, perhaps most of us,

linked in partnership with the Bass Drum in Circus and some Military Bands. However, when treated independently they are capable of a variety of dynamic effects; (1) by clashing them together,* (2) by striking one of them with a Kettle Drum stick (see the *Ride of the Valkyries*), (3) by performing a roll on a suspended Cymbal with two of these drumsticks. This is the means adopted by Wagner in Scene III of *Das Rheingold* swelling from *pp* to *ff* suggesting Alberich's lust for gold. Be it remarked in this connection that without the rich harmonies in the Brass, etc. this effect would be nothing but brutal noise, whereas the combination is gorgeous.

The Gong

The Gong has been so long associated with the call to dinner in American country hotels or on steamers at sea, that it is difficult for some readers to consider it seriously. And yet it is worthy of respect, for in the Orient it has for many centuries been used in religious services and state ceremonies. It is called by the French *Tam Tam*† and was first introduced as

*The old English name for them was *Clash-Pans*—Ger. *Becken* or Basins, Gr. *Kymbelon* or *Kymbalos.*

†Authorities differ concerning the derivation of *Tam Tam.* Some will have it from the Sanskrit *tum-tum;* others from the Malayalem *Tammittam,* but it would seem from the very sound to explain itself, being as essentially onometapoetic as the child's *choo-choo* for locomotive. In this connection, attention may be called to other sound-simulating words which suggest certain instruments, such as Gong, Drum, Rattle, Cricket and *Schnarre,* or Snare.

an orchestral instrument by the Parisian composer Gossec in a funeral march played at the obsequies of Mirabeau, April 1791, when it made a deep impression. A few years later it was heard in the operas of Spontini, Meyerbeer and others, while more recently, even in a symphony its sombre tones have deepened the gloom of a tragic mood as in Tchaikovsky's *Pathétique.**

Triangle, Castagnets and Cricket

These too have been adequately described in Chapter I, where the incessant beating of the Triangle was cited as peculiar to Turkish Military Music. But this monotonous use of any percussion instrument is not in keeping with the ideals of the great composers who have found it wise to employ these high lights of musical emphasis with cautious economy. Wagner even in such exuberant outbursts as we hear in the *Magic Fire Music* (See No. 74) added the metallic tints of Triangle and Glockenspiel to his tone painting, but each only in a very few measures. In keeping with this economy is the sparing employ-

*The Xylophone is fittingly described by the French *clacque bois*, while the German *Dudel-sack* aptly hit off the idiom of the Bagpipe. Some of the words invented by the more primitive peoples are quaintly effective. Thus the sacred Trumpet of the Orinocos is naïvely figured in *Bo-tu-tu*, while the Aztecs suggested their little Bells in the delicate *Tzillinils*. This last reminds one of the *tintinnabulum* of the Romans, whence came Edgar Poe's "*tintinnabulation* that so musically wells," in the poem that tellingly demonstrates the resounding qualities of the vocable "bell."

ment (20 odd measures) of Xylophone which impart its weird coloring to the entire *Danse Macabre* by Saint-Saëns.

The Castagnets are naturally of special value in Spanish scenes and among such nothing is more striking than the song and dance of Carmen in Act II of the opera of that name. This number shows also what a genius can do with meagre material. The second verse of her song is accompanied by the notes of the approaching buglers in search of Don Jose. Nothing but these natural Bugle tones, the Castagnets and Strings figure in this number and yet how romantic and complete.

The employment of the Cricket in Haydn's *Children's Symphony* like his use of the Bass Drum in his *Military Symphony* commands a certain degree of respect as local color.

The Orchestral Score

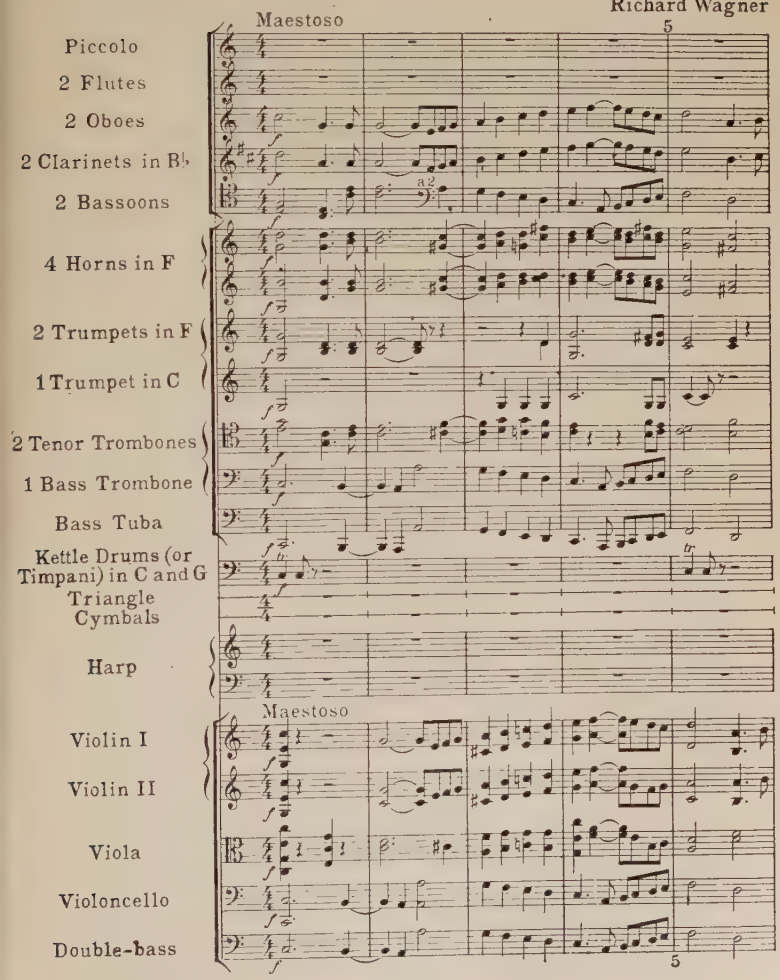
In order that the conductor might definitely know what was required of each instrument at any given moment, it was found necessary to place the various parts in regular order, one above the other, so that the notes at each beat of the measure should appear in perfect "alignment." This arrangement of the parts (called *partition* by the French, *de's Partitur* by the Germans) was known in the 16th century, a cele-

THE MASTERSINGERS OF NUREMBERG

(DIE MEISTERSINGER VON NÜRNBERG)

(Prelude) 1867 (Vorspiel)

Richard Wagner



brated instance being Monteverde's *Orfeo* 1608.* But it was a long time before there was any definite system followed in the arrangement of the instruments in a score. Indeed, at the present day scoring is not absolutely stabilized, but in the main the models afforded by the works of Wagner and Tchaikovsky are followed, and the various instrumental parts are usually arranged in the order shown in the quotation from the score of the Prelude to *Die Meistersinger*, page 215. You will notice that the Wood-wind is placed on the top of the score. Immediately below is the Brass section, beneath them the Percussion instruments, and the Harp or Piano if these are employed, while the String choir or section is at the foot of the score.

To give an idea of what chaos reigned prior to Beethoven's later period a series of the first six of Mozart's symphonies as given in Breitkopf and Haertel's edition is shown in the following table, which lists the instruments as they appear in the scores, reading from top to bottom.

*A curious feature of the ancient scores was the staff with figures denoting the harmonies to be filled in by the performer on the Harpsichord or Organ. Often this was the duty of the director himself and it may well be believed that the elaborations (improvisations) of Bach and Handel were wonderful to hear. These figured basses inasmuch as they *continue* or go *through* the entire piece show the origin of the terms *basso continuo* or *thorough bass.*

No. 1 in *D*	No. 2 in *G-min.*	No. 3 in *E*
1. K. Dr.	Hr. 1 in *B.*	K. Dr.
2. Tpt. 1, 2.	Hr. 2 in *G.*	Tpt. 1, 2.
3. Hr. 1, 2.	Fl. 1.	Hr. 1, 2.
4. Fl. 1, 2.	Ob. 1, 2.	Fl. 1.
5. Ob. 1, 2.	Bsn. 1, 2.	Cl. 1, 2.
6. Bsn. 1, 2.	Vl. 1.	Bsn. 1, 2.
7. Vl. 1.	Vl. 2.	Vl. 1.
8. Vl. 2.	Vla.	Vl. 2.
9. Vla.	Vcl. & D. B.	Vla.
10. Vcl. & D. B.		Vcl. & D. B.

No. 4 in *C*	No. 5 in *D*	No. 6 in *C*
1. K. Dr.	K. Dr.	Vl. 1.
2. Tpt. 1, 2.	Tpt. 1, 2.	Vl. 2.
3. Hr. 1, 2.	Hr. 1, 2.	Vla.
4. Ob. 1, 2.	Ob. 1, 2.	Ob. 1, 2.
5. Fl. 1.	Bsn. 1, 2.	Bsn. 1, 2.
6. Vl. 1.	Vl. 1.	Hr. 1, 2.
7. Vl. 2.	Vl. 2	Tpt. 1, 2.
8. Vla.	Vla.	K. Dr.
9. Bsn. 1, 2.	Vcl. & D. B.	Vcl. & D. B.
10. Vcl. & D. B.		

Obviously Mozart wrote for such instruments as were at his disposal. Sometimes he had but one Flute and again he had two. He was so pleased with the recently introduced Clarinets that he sometimes substituted them for the Oboes in his symphonies, their softer tones blending more readily with the small body of strings in his orchestra. In his operas *Magic Flute* and *Don Juan* Mozart employed both

Clarinets and Flutes but not until Beethoven's régime did each type find a regular place in the symphony.

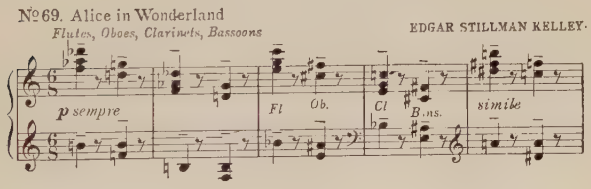
Orchestral Antiphony

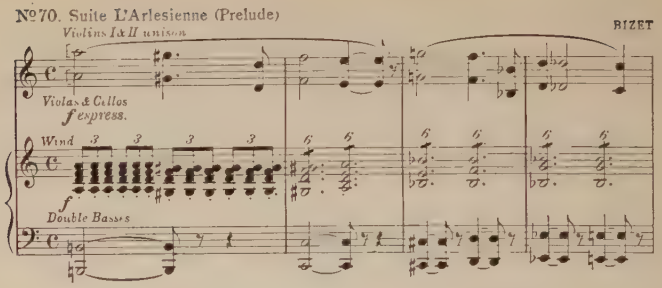
The singing of the ancients was chiefly in unison or in octaves. Variety was imparted to the music of the Hebrews, Greeks and Romans by dividing the mass of singers into two groups which sang alternately, one group answering the other. This form of *antiphonal* singing is known to have been employed in rendering the Psalms of David and was later continued in the Christian Church. Herbert Spencer suggests that one of the choirs may by accident have begun before the other had finished and this may have led to experiments in polyphonic singing and ultimately developed in the fugue.

After the wind division of the orchestra had evolved sufficiently to hold its own against the strings this antiphonal method was applied. Notable instances are to be found in the symphonies of Beethoven, as in the first movement of the 5th and 8th, the *Scherzo* of the 7th, etc.

Especially since the finer expressiveness of the modern Wood-wind has developed, this group, aided by the Horns, is made to answer the statement of the Strings and *vice versa*. Striking illustrations are to be found in the Prelude to *Tristan and Isolde* also in the later symphonies by Tchaikovsky. Perhaps no

one has applied this antiphony in so remarkable a manner as in the *Scherzo* of his *F minor Symphony*, where the strings, all in pizzicato, play the entire main theme, the brass alone have the second theme alternating with the wood, followed by the repetition of the principal theme by the strings—while at the close all the motives are charmingly intermingled.

It seemed appropriate to the author in suggesting the bewilderment of Alice, on entering the "Forest of Forgetfulness" to give each successive chord of the two-measure phrase to the Flutes, Oboes, Clarinets and Bassoons respectively.

Novel Group Combinations

The experiment of giving the melody to the string group and the harmony to the Wind and Double Basses is a modern device and has been effectively applied by Bizet, as in No. 70, in this excerpt from the *Suite L'Arlésienne* and has been utilized with marked success in the Tchaikovskyan symphonies.

It was shown in Chapter II how Wagner in *Lohengrin* and all his later operas, excepting *Die Meistersinger*, employed threefold groups of wind instruments instead of the customary pairs in order to obtain complete triads in each tone color. The increased richness of tone volume and the new combinations in tone color this innovation made possible has led to the general adoption of the threefold system by modern composers, who frequently use 3 Flutes, 3 Oboes, 3 Clarinets, 3 Bassoons, 3 Trumpets and 3 Trombones.

Influence of the Improved Instruments

We have seen how both Trumpets and Horns were introduced, cautiously in the opera, merely as local color, and how, through the steady improvements in those instruments, they became orchestral voices of inestimable value. Wagner, above all, was influential in elevating them from their humble position of adding the most conventional platitudes of a dig-

nified participation in the orchestral conversation. Witness how eloquently the Horns emphasize the pathetic theme of the *Love Potion* in the Prelude to *Tristan and Isolde* and how the climax is reached when the same theme like a cry of despair, is uttered by Trumpets and Trombones. Such harmonies and such orchestration would have been impossible fifty years previous when, as before mentioned, both Trumpets and Horns were in their medieval cultural condition. And yet, singular as it may seem, many noted composers such as Mendelssohn and Brahms, still continued to use Trumpets and Horns without valves, in spite of the significant precedents of Schumann and Wagner which led to such ideal results.* Thus Brahms, in his *C Minor Symphony* written some ten years after *Tristan and Isolde,* employs medieval Horns and in the last movement arranges a pause of 35 measures to enable the 3rd and 4th Horn (in *E*) to change their crooks so as to play in the key of *E♭*, and later on they are given another pause of 21 measures to help them change to the key of *F,* after the manner of Beethoven in his *Eroica* Symphony written in 1803-4. Not only did these later writers cramp themselves harmonically by clinging to the old for-

*The scholarly Gevaert in his *Traite d'Orchestration* aptly comments on this procedure as follows: "When a composer disregards the improvements in the instruments which characterize his epoch, he resembles the general who persists in employing the cannon and other weapons of war belonging to a former period."

mulas, but many of their themes bear the ear-marks of ultra-classicism.*

Improved Instruments

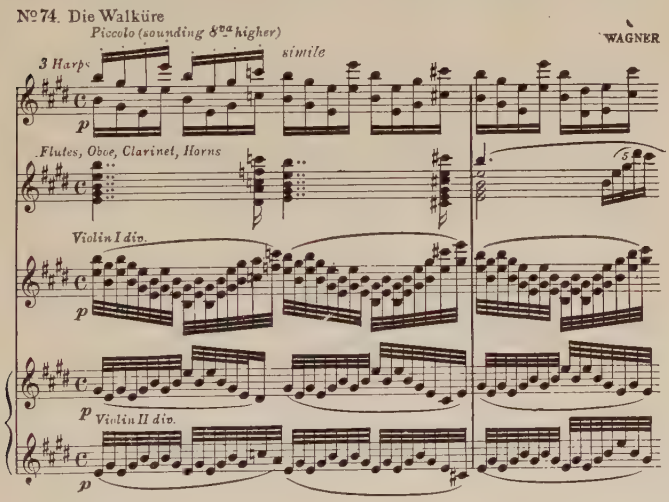
The Chromatic Brass also, revolutionized many other phases of orchestration, whereas in the time of Bach, Haydn and Mozart, composers writing melodic passages for Horn were confined to the strident upper tones which usually protrude rather painfully beyond the remainder of the orchestra. Now similar phrases are possible in the softer middle register of the Horn, the tones of which blend well with strings, woodwind or brass. The rough low bass-notes of the Bassoon which can scarcely utter a *piano* without difficulty can now be replaced by the Horn capable of the most delicate shading.

The greater flexibility of Trumpets and the Bass Tuba, which has wholly displaced the old Ophicleide, has been previously discussed. Chromatic passages for Trumpet are often found in the works of Strauss (*Don Juan*) while rapid runs for the Tuba are not infrequent as in Mascagni's *Cavalleria Rusticana.*

*The lyric theme from Tchaikovsky's *Sixth Symphony* has already been twice quoted in this series—Gehrkens' p. 68, Mason p. 217, the former in appreciation, the latter in depreciation. Apart from all matters of taste, the excerpt affords a fine illustration of what the Valve-Horns enabled the composer to express. If the student will but refer to this quotation and number the *complete* measures it will be seen that the harmonies occuring on the third quarter-beats of measures 1, 3, 6 and 7, could never have been scored for the old Horns by Brahms or any other person even had they occurred to him. Later in the symphony these harmonic effects are elaborated in a manner as masterly as they are impressive.

Utilizing Orchestral Virtuosity

After the improvement and apparent perfection of the various orchestral instruments the performers naturally revelled in the new technical possibilities and a proficiency on all was ultimately acquired such as would have dazzled the artists of the preceding century. But the new achievements were displayed chiefly in solo work* until Wagner had the temerity



to demand the application of this orchestral virtuosity to his music dramas. At the great Bayreuth Festival of 1876, Wilhelmj who was the concert master on this occasion told a friend of mine that he sat

*There were concertos not only for Piano, Violin, 'Cello, but for Flute, Oboe, Clarinet, Bassoon, Horn, etc. and show-pieces for Trumpet, Trombone, etc. The concert-master is the leader of the Violins.

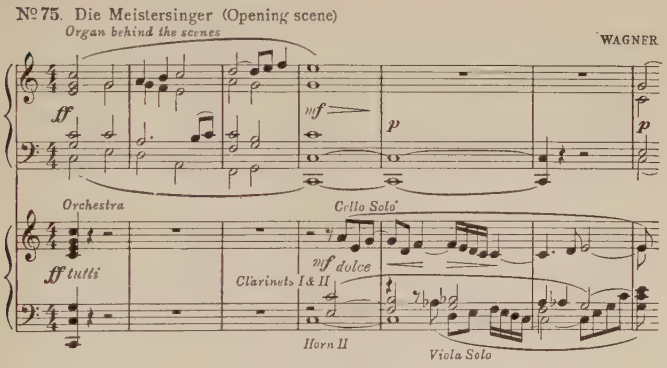
up nights practising passages that seemed impossible and told Wagner that they could not be played. The composer replied "What I want is the general effect. The notes one player misses another will play." One of the places Wilhelmj referred to was in the *Magic Fire Scene* at the close of *Die Walküre* where the Violins are given unheard-of figures suggesting the flickering of the flames.

Orchestra and Organ

Many have been the efforts to combine the Organ with the Orchestra in oratorios, concertos, etc. with varied success. Berlioz in his work on Orchestration expresses his opinion that their natures are too conflicting like those of Emperor and Pope for them to coalesce. Possibly the proper means of blending them had not been sufficiently studied in that day. In recent years Pierné has achieved some charming results in his oratorio *St. Francis* by letting one voice-part in certain delicate registers of the Organ join the orchestral forces as an accessory instrument.

Among modern compositions in which the Organ is employed as an instrument of the orchestra are: Saint-Saëns *Symphony No.* 3, *in C minor,* Liszt's *Dante,* Tchaikovsky's *Manfred,* Widor's *Sinfonia Sacra,* and Loeffler's *Villanelle du diable.*

A beautiful illustration of what may be accomplished by permitting the Organ to retain its eccle-

siastical character while the Orchestra remains a live emotional creature, may be found in the opening measures of *Die Meistersinger*. Here the organ accompanies the Choral sung by the congregation and the Orchestra during the interludes gives voice to the charming love motive of the Knight Walther.

The Slow Evolution of Musical Art

Allusion was made in the Introduction to the painfully slow and very gradual growth of all these means of controlling sonorous vibrations, which we term Musical Instruments. The time involved in the evolution of these mechanical devices is, we may say, paralleled or coexistant with the period demanded for the growth of man's *aural* intelligence, the capacity of the human ear to discern and appreciate the finer distinctions in the shades of sound and the apprehension of the subtler tone combinations.

Specialists tell us that eighty per cent of our knowledge of the phenomena of the universe is derived through the medium of the *eye*, while but twenty per cent is acquired through the agency of the *ear*. The eye can enjoy the contemplation of a given object by the hour if desirable, in order to obtain the necessary impression upon the memory. The ear, on the other hand, can take cognizance of but one detail or grasp a combination of details produced at a given instant of time, which obviously involves a much greater effort of the memory.

A striking illustration throwing light on this growth of tone-perception is afforded by a passage quoted by Helmholtz from the Problem XIX (*de Audibilus*) of Aristotle (*B. C.* 384-332) who, like so many other ancients and Orientals of all periods preferred *homophony* or one voice-part music to the singing or playing of two or more, even when they produced consonant intervals. Says the learned philosopher, "On this account we understand better when we hear but one person speak than when several say the same thing. Thus too is it in regard to stringed instruments, and still worse is it if the Kithara is played while the Flute is performed, because the voice-parts then flow in together. Especially is this true of consonances, for the tones then mutually conceal each other."

Since the days when man could but feebly follow a slow succession of single tones, to the present time when the musical layman not only appreciates but demands a harmonic complex which would have mystified even his more recent ancestors, the growth of music and the kindred arts gives clear indication of the progress of mankind and his ever increasing sensitiveness to beauty in form, color and sound.

The art of beauty in sound—music—the most immaterial of the arts, has been the last to develop, and it will be the function of the fourth book in this Course of Study to fully trace that development which in the present volume has been merely indicated as a gradual growth in aural sensitiveness accompanied by a similar growth in the means of expression through sound-producing instruments.

The Greek masters of the Golden Age, architects, sculptors, poets and dramatists, gave to the world works that have served as models for the artists of all subsequent periods. But in the domain of music there have been found only a few straggling fragments, consisting chiefly of monotonous chantings that testify to the limitations of Hellenic musical achievement.

Even in Rome when the Pantheon and Colosseum were erected, the psalmody of the Jewish and Christian communities was characterized by simple unharmonized melodies and chants.

Not until nearly a thousand years had elapsed, and St. Mark's Church at Venice appeared as the climax of Byzantine art, did it occur to musicians that it was possible to have two independent voice-parts. The result was the *Organum* of Hucbald with its crude successions of parallel fourths, fifths and octaves.*

Some two centuries thereafter, when the glorious cathedrals of Strasburg and Cologne were well under way, and the poet Dante was writing his *Divine Comedy*, musical authorities were beginning to concede that progressions of parallel *thirds* might be permitted.

During the wonderful activity of Leonardo da Vinci, Raphael and Michael Angelo, the German chorale began to make itself felt. It was simple indeed, but its four-part harmony and lyric structure was pregnant with potentiality.

Shakespeare and Milton who soon followed were both of them keenly susceptible to the power of music and doubtless divined its latent possibilities, but there appeared in their day no tone creations comparable to their transcendent poetry.

Not until another century and a half had elapsed did music of parallel value with other arts appear when we find Bach, Handel, Haydn and Mozart taking rank along with Goethe, Schiller, Reynolds,

*See p. 89.

Gainsborough and other poets and painters of that day.

Finally in the nineteenth century, after the kindred arts had held their sway over mankind for some two thousand years, Music became prominent and for a time in certain respects surpassed the achievements of her sisters. Where, for instance, do we find contemporaneous works in the other fields of art that in regard to absolute novelty of design and unusualness of emotional power are to be classed with the symphonies of Beethoven and Tchaikovsky, the songs of Schubert and Schumann, the piano poetry of Chopin, and the music dramas of Wagner?

The attentive reader of this book must before this have recognized the parallel development of music and the instruments through which it found its utterance. The two are inseparable and it is interesting to note that the three great innovators, Bach, Beethoven and Wagner, enlarged the boundaries of musical expression through the employment of newly invented instruments, and promoted the improvement of those already in use.

In one of the galleries of the Metropolitan Museum in New York may be seen portraits of Washington and Franklin painted by a Chinese artist. We instantly recognize the persons intended but we likewise realize that these pictures are a vizualization of the great Americans through Mongolian eyes. For

similar reasons the Italian and Spanish cartoonists inevitably depict Uncle Sam as an Italian or a Spaniard. As Prof. Stumpf says, "the hand of the artist is guided by the brain with its local traditions rather than by the eye."

We of Occidental tastes and traditions have learned to value the pictorial and architectural art of Asiatic, African and other peoples, even when their conceptions of the beautiful do not correspond with our own, for we take pleasure in seeing how the world *looks* to them.

If we devote a reasonable share of our time to the sympathetic study of their music, no matter how foreign to our predilections, we shall find that they too have ardently sought to express in tones the emotions and spiritual longings of humanity. We thus obtain an idea of how—in a certain sense—the universe *sounds* to them.

Any effort that can bring us to a more clarified comprehension of the manifold conceptions of mankind will be a needed and welcome step in the direction of international good-will and universal friendship.

Questions for Review

1. Why is it necessary to plan for more strings than wind instruments in an orchestra?
2. Are the modern orchestras larger or smaller than that of Mozart and why?
3. What is the mission of the truly artistic conductor?
4. Mention certain instruments occasionally introduced in the orchestra for special effects.
5. What is the general character of the Harp and where is it appropriately employed?
6. In what opera was the Lute introduced?
7. Tell something of the Gong and when it has been employed in serious compositions.
8. What is an orchestra score?
9. How are the instruments usually grouped at the present day?
10. Tell something of *antiphonal* effects in orchestral music.
11. In what opera of Wagner do we find that first instance of a *dialogue* between the Wind and String groups?
12. In what great modern symphony do we find a similar antiphonal effect?
13. How did Wagner make use of the virtuosity of his orchestra performers?
14. Tell something of the combination of Orchestra and Organ and when appropriate.
15. Tell something of the slow development of music as compared with the other arts, adding a few illustrative instances.

References

Hamilton	Sound and its Relation to Music, Chapter IX.
Berlioz	Orchestration.
Coerne	The Evolution of Modern Orchestration.
Lavignac	Music and Musicians.
Prout	The Orchestra (Two Volumes).
Henderson	The Orchestra and Orchestral Instruments.
Mason	The Orchestral Instruments and what they do.
Singleton	The Orchestra and its Instruments.
Forsyth	Orchestration.
Grove's Dictionary	*Articles*: Orchestra, Orchestration, Conductor, Symphony, Concerto, also biographical sketches of composers mentioned.

(The miniature scores published by Eulenberg (Leipzig), Donajowski (London), and the Philharmonic Scores (Vienna), are to be recommended to musical students. For orchestral scores of shorter and simpler works see *The Philharmonic Orchestra Series* published by Oliver Ditson Co.)

ILLUSTRATIVE RECORDS AND ROLLS

Records:

B—Brunswick; C—Columbia; E—Edison; V—Victor.

Rolls:

A—Ampico; D—Duo-Art; M—Melodee; Q—QRS.
W—Welte-Mignon.

MUSIC MENTIONED IN CHAPTER VIII

BEETHOVEN—Symphony No. 3, in *E♭* (*Eroica*) C; M, Q.

BEETHOVEN—Symphony No. 7, in *A* (*Scherzo*) C, V; M, Q.

BIZET—Song and dance of Carmen (*Carmen*, Act II) C, V.

BIZET—Prelude, *Suite L'Arlesienne* C.

BRAHMS—Symphony No. 1, in *C-minor* (*First and last movements*) C; A, M, Q.

HAYDN—Children's Symphony C, V.

ROSSINI—Overture, *William Tell* B, C, V; A, D, M, Q, W.

SAINT-SAËNS—Danse Macabre B, V; D, M, Q, W.

STRAUSS—Don Juan (*Symphonic Poem*) V.

TCHAIKOVSKY—Danse Arabe (*Nutcracker Suite*) C, E, V; D.

TCHAIKOVSKY—Symphony No. 4, in *F-minor* (*Scherzo*) M, Q.

WAGNER—Elsa's Dream (*Lohengrin*) V; A.

WAGNER—Magic Fire Scene (*Die Walküre*) C, V; A, D.

WAGNER—Prelude, *Die Meistersinger* V; M, Q, W.

WAGNER—Prelude, *Tristan and Isolde* C, E, V; Q.

WAGNER—Procession of the Grail (*Parsifal*) C, V.

INSTRUMENTS MENTIONED

Harp, HASSELMANS—Menuett V.

Lute, D'ARCADELT—Il bianco cigno V.

Bells, ELGAR—Carrillon V.

Glockenspiel, DELIBES—Bell Song, Lakme V.

Xylophone, GRETRY—Gavotte V.

Celesta, RAVEL—Mother Goose Suite (*Third movement*) V.

Snare Drum, AUBER—Overture, *Fra Diavolo* V.

Tambourine, MOSZKOWSKI—Malagnena V.

Cymbals, HERBERT—Military Ball (*Babes in Toyland*) V.

Gong, PUCCINI—Finale, *Madame Butterfly* V.

Triangle, MOSZKOWSKI—Malagnena V.

Castanet, BIZET—Spanish Serenade V.

MUSICAL INSTRUMENTS, 17th CENTURY

INDEX

AÏDA (Verdi), 155
Aladdin Suite (Kelley), 71
Alice in Wonderland (Kelley), 177, 219
Amati, Andreas, 137
Apollo, 3
Archlute, 69
  Bass, 69
Aristotle, 226
Aulos, Greek, 32, 38, 62, 63, 198
Augustine, Saint, 94

BACH, J. S., 54, 70, 93, 94, 95, 118, 206, 216, 222, 228, 229
Bagpipe, 213
Bandora, 72
Banjo, 6, 72
Barcarolle (Chopin), 129
Bass Bugle, 191
  Clarinet, 43, 169, 171, 177, 181, 182, 219, 220
  Drum, 18, 210, 211, 212, 214
  Flute, 42, 43, 169
  Tuba, 187, 191, 222
Bassoon, 36, 41, 43, 169, 174, 175, 176, 179, 182, 192, 219, 220, 222
  Double, 176, 177
Basso continuo, 216
Beethoven, L. van, 117, 123, 124, 125, 140, 150, 168, 177, 200, 210, 216, 218, 229
Beginnings of music, 2
Bells, 22, 23, 183, 206, 207
  Aztec, 23
  Chinese, 23
  Russian, 23
  Spanish, 23
Ben Hur Music (Kelley), 172
Berlioz, Hector, 20, 190, 200, 224
Bizet, Georges, 214, 219
Boehm, Theobald, 167
Bombard, 40, 41
Bones, 18
Botessini, Giovanni, 155
Bow, value of, 77
Brahms, Johannes, 130, 131, 132, 177, 203, 221, 222
Brass, The, 164, 182
  chromatic, 222
Broadwood, John, 122, 125
Brown, Dr. William Adams, 55
Brown, Mrs. Crosby, 8, 55
Bugle, 48, 191
Burney, Dr., 72
Butterfly (Grieg), 130
Buxtehude, Dietrich, 93
Byrd, William, 112, 113
Bull, Dr. John, 113

CAPRICCIO Espagnol (Rimsky-Korsakoff), 145
Calliope, 88
Carmen (Bizet), 214
Carthage Organ, 85, 86, 89

Castagnet, 13, 18, 209, 213, 214
Cavalleria Rusticana, 222
Celesta, 203, 205, 208, 209
Cello (See *Violoncello*)
Cembalo, 75
CHALUMEAU, 39, 177, 178
Chêng, 55
Children's Symphony (Haydn), 214
Chime, Stone, 21
CHICKERING, JONAS, 132
Chitarrone, 69
CHOPIN, FRÉDÉRIC, 122, 128, 129, 229
Chopin's use of the pedal, 128, 129
Chromatic brass, 222
Chromatic Fantasie and Fugue, 118, 119
Chromatic horn, 186-188
Cithara, Greek, 63, 226
Citoli, 66, 67
Cittern, 66, 67
Clappers, 18
Clarinet, 32, 36, 43, 165, 166, 171, 178, 179, 180, 181, 182, 217, 218
  Bass, 43, 169, 171, 177, 181, 182, 219, 220
  family, 177-180, 192
Clavi-Cembalum, 77
Clavichord, 77, 112, 115, 116, 117, 119, 121
Clarinetto, 178
Compass of orchestral instruments, 193
Concerto in Eb (Liszt) 128
Consort, A, 44, 68
Control of sonorous vibrations, 3
Coq d'Or, Le, 170, 179, 205, 206
Cornet, 6, 43, 187, 189
Cornet-a-Piston, 189
Cornetto, 53
Cremona, 136
Cricket, 13, 209, 212, 213, 214
CRISTOFORI, BARTOLOMEO, 120, 121, 122
Croit, 64
Crot, 64
Crowd, 79
Crwth, 64, 79, 80
Cymbalom, 76, 77
Cymbals, 18, 19, 203, 209, 211

DAMPER PEDAL, 125, 126
Danse des Mirlitons, 168
Danse Grecque, 168, 197, 198
Danse Macabre, 138, 145, 146, 208
Danse Arabe, 211
Dante (Liszt), 224
DANTE, ALIGHIERI, 228
DeeDah, The, 37
DEKOVEN, REGINALD, 185
Don Juan (Mozart), 71, 217
Don Juan (Strauss), 222
Double-Bass, 41, 136, 147, 152, 153, 154, 155, 176, 177
  Bassoon, 176, 177
  Flute, 32
Drum, 3, 5, 15, 16, 17, 19, 37, 43, 45, 203, 210
  Bass, 18, 210, 211, 212, 214
  Hand, 211
  Kettle, 25, 176, 191, 192, 203, 210, 211
  Snare, 210, 211
  with indefinite tone, 210, 211

Dufay, Guillaume, 90
Dulcimer, 6, 65, 75, 76, 77, 111, 112, 113
Dvořák, Anton, 172, 174, 175

Egmont Overture, 140
Elgar, Edward, 149
English Horn, 43, 167, 173, 174
Equal temperament, 118 119
Evolution of musical art, slow, 225
instrumental, 5-9
Euclid, 64

Faust (Gounod), 173
Faust (Wagner), 191
Feast of Lanterns (Kelley), 71
Fidelio (Beethoven), 210
Fife, 6, 43
Flageolet, 166
Flauto traverso, 32, 166
Flügel, 121, 122
Flute, 6, 8, 31, 32, 43, 50, 165, 166, 167, 168, 171, 172, 207, 217, 218, 219, 220, 226
Aztec, 60
Bass, 42, 43, 169
Double, 32
Fipple, 41
scale, 33
Whistle, 33, 41
family, The, 167, 169, 192
Flying Dutchman, The, 170
Fra Diavolo (Auber), 207
Franklin, Benjamin, 229
Freischütz, Der, 180, 191, 210
French Horn, 43, 187

Gainsborough, Thomas, 229
Galpin, Rev. F. W., 86
Gevaert, F. A., 21, 169, 199, 221
Gilmore, P. S., 200
Girl of the Golden West, 73
Gittern, 66, 67
Glissando whistle, 208, 209
Glockenspiel, 203, 207, 213
Gluck, C. W. von, 54
Goethe, J. W. von, 30, 228
Gong, 18, 19, 212
Gossec, F. J., 213
Götterdämmerung, 179, 211
Gounod, Charles, 173
Gourd, 11, 12
Gretry, André, 183
Grieg, Edvard, 129, 130, 175
Guarnerius, Andrea, 137
Guitar, 6, 67, 68, 71, 203, 206
Gyo, 13

Hadley, Henry, 177
Halberstadt, 90, 91, 92
Handel, Geo. F., 95, 216, 228
Harmonium, 56
Harmonic Series, 47, 178
Harold in Italy (Berlioz), 190
Harp, 6, 59, 65, 71, 78, 183, 197, 203, 204, 205
Egyptian, 59
English, 61
Irish, 61
Modern, 61
Harpsichord, 72, 77, 112, 114, 117, 119, 120, 121, 216
Harris, Baker, 111
Hautboy, 43

Haydn, Franz Josef, 183, 214, 222, 228
Haydn's baryton, 157
Haydn's piano, 126
Helmholtz, Hermann von, 26, 125, 165, 226
Holden, Oliver, organ of, 105
Homophony, 226
Horn, 6, 7, 32, 44, 45, 46, 47, 48, 49, 50, 53, 69, 165, 169, 181, 188, 218, 220, 221, 222
Chromatic, 186-188
Crooks, 183, 184
English, 43, 167, 173, 174
Forest, 50
French, 43, 187
Hunting, 50
Russian, 51
Stopped tones, 184, 186
Valve, 189, 222
Hrotta, 64
Hucbald, Organum of, 89, 228
Hugenots (Meyerbeer), 157
Hungarian Rhapsodies, 73
Hydraulus, 85, 98

ILLUSTRATIVE RECORDS AND ROLLS, 29, 58, 82, 135, 162, 195, 232
Indians (See *Musical Instruments*)
North American, 3, 12, 15, 16, 20, 34, 36
Pueblo, 16
Sioux, 20
Virginia, 12
Winnebago, 15
Influence of environment, 6
Instrumental evolution, outline of, 5-9
Instruments of percussion, 9-26, 206, 214
Non-symphonic, 209
Primitive and Oriental, 5-26
with definite pitch, 20-26, 206-209
with indefinite pitch, 11-19, 210

KAZOO, 209
Kettle Drums, 25, 176, 191, 192, 203, 210, 211, 212
Keys, function of, 166
King, (See *Pien King*)
Kirkman, Jacob, 115
Kithara, 63, 226
Kussevitski, Sergei, 155

LAKMÉ (Delibes), 207
Liszt, Franz, 73, 192, 224
Loeffler, Charles M., 224
Lohengrin, 42, 143, 153, 154, 205, 220
Longfellow, Henry W., 136
Luren, 45
Lute, 6, 44, 47, 66, 67, 68, 69, 70, 71, 72, 79, 80, 117, 203, 206
relatives of, 65-67
Lyre, 3, 62, 63, 65, 78, 198

MACBETH *Music* (Kelley), 185
MacDowell, Edward, 55, 130, 153, 203
Magdeburg Cathedral Organ, 89
Magic Fire Scene, 170, 208, 213, 224
Magic Flute (Mozart) 217

Mandola, 70, 71
Mandoline, 6, 67, 70, 71, 203, 206
Manfred Music, 174, 224
Marimba, 25
MARIUS, 120
MASCAGNI, PIETRO, 222
MASSENET, JULES, 197, 198
Mathematics and Music, 64
Meistersinger, Die, 70, 146, 185, 206, 215, 216, 220, 225
Melodeon, 56
MENDELSSOHN, FELIX, 55, 221
MEYERBEER, GIACOMO, 157, 200, 213
MICHAEL ANGELO, 228
Mikado (Sullivan), 210
MILTON, JOHN, 83, 228
Mixtures, Organ, 96
Modern orchestra, 197-230
Moloch (von Schillings), 184
Monochord, 64, 67, 78, 79
MONTEVERDE, CLAUDIO, 216
MOZART, W. A., 71, 122, 199, 217, 222, 228
Murali, 32
Music and Mathematics, 64
Music, beginnings of, 2
Music of the Spheres, 2
Musical art, slow evolution of, 225
Musical Instruments
  Brass-wind, 164, 182, 222
  Brass, chromatic, 222
  classification of, 9, 10, 11, 35, 60
  collections of, 8
  mythical origin of, 2, 3
  Origin of
    African, 11, 17, 40
    Algerian, 17
    American (See Indians of)
    Arabian, 31, 37, 38, 65, 66
    Assyrian, 22, 32
    Britons, early, 46
    Chinese, 3, 12, 18, 19, 21, 23, 30, 31, 37, 55, 56, 71, 73, 75, 76, 78, 79, 95, 109
    Egyptian, 31, 59
    Grecian, 3, 18, 30, 32, 38, 62, 63, 86, 198
    Hebrew, 22, 30
    Hindoo, 2, 32, 73, 74, 75, 79
    Indians of
      America, Central, 25
      America, North, 3, 12, 15, 16, 20, 34, 36
      America, South, 31, 33, 39, 46, 213
      Aztec and Mexican, 11, 12, 23, 33, 34, 60, 213
      Oceanica, 31, 33, 39, 46
    Japanese, 13
    Javanese, 24, 25
    Moorish, 13
    Oriental, 9, 22
    Paleolithic, 33
    Phoenician, 13
    Roman, 18, 46
    Russian, 23, 51
    Saracen, 15, 46
    Scots, early, 46
    Spanish, 13, 23
    Turkish, 18, 19
    Welsh, 64
  percussion instruments, 9-26, 206-214
  primitive bowed instruments, 78-80

Reed instruments, 36-41
Stringed instruments, table of, 60
table of, 35
ultimate import of, 4
Wind instruments, 30-56, 164, 182
Wood-wind, 164, 182

NACHTSTUCK (Schumann), 127, 128
Nature scale, 47, 48
Nibelungen trilogy, 189
North American Indians (See *Indians*)
Notched stick, 12, 13
Nutcracker Suite, 168, 209, 211

OBOE, 36, 37, 39, 41, 43, 49, 95, 165, 166, 167, 172, 173, 174, 177, 178, 207, 217, 219, 220
Oboe, family, 172, 175, 192
Ophicleide, 55, 191, 222
Orchestra, conductor of, 201
modern, 197-230
ornamental instruments of, 203
positions of performers, 200
proportions of, 199, 200
seating of, 201
with organ, 224, 225
Orchestral homogeneity, 199
instruments, compass of, 193
virtuosity, 222
Orchestral score, 214-218
miniature, 232
Orchestration, medieval, 43, 44
Orfeo (Monteverde), 216
Organ, 31, 56, 83-107, 169, 216
and orchestra, 224, 225
Carthage, 85, 86, 89
console, 102, 103
electro-pneumatic action, 97, 98
eleventh century, 88
Halberstadt, 90, 91, 92
Magdeburg Cathedral, 89
mixtures, 96
of Oliver Holden, 105
pneumatic action, 97, 98
portative, 91
positive, 91
reed, 56
swell, 96
thirteenth century, 93
water, 85, 86
Winchester Cathedral, 87, 88, 89
Organum, of Hucbald, 89, 228
Otello (Verdi), 71
Outline of Instrumental Evolution, 5-9
Overblowing, 33, 48, 178

PAGANINI, NICCOLO, 138
PALESTRINA, GIOVANNI, 90
Pan, 3
Pandean pipes, 3, 31, 55, 84
Pan-pipes, 6, 30, 31, 39
Parsifal, 207
Part-playing, development of, 199
Part-singing, development of, 198
Pavillon chinois, 19
Pedal, damper, 125, 126
Peer Gynt Suite, 175
Percussion instruments, 9-26, 206-214

Philidor, F. A. D., 183
Pianoforte, 65, 72, 77, 108-135
American improvements, 132
Grand, 122
Square, 121
Piccolo, 170, 171, 205
Pien-King, 3, 21, 22, 109
Pierné, Gabriel, 224
Pipe, 31, 197
Pipe scale, 31
Pitch designation in Organs, 94
Plato, 5
Plectrum, 62
Pop-gun, 209
Pommer bass, 175
Psaltery, 75, 76, 77, 111, 112, 113, 197
Puccini, Giacomo, 73
Pueblo Indians, 16

QANON, 77
Questions for review, 27, 56, 81, 105, 133, 161, 193, 231

RAPHAEL, 228
Rattle, 5, 11, 12, 17, 45, 212
Ravanastron, 79
Rebec, 47, 78, 79, 80
Records and Rolls, Illustrative, 29, 58, 82, 135, 162, 195, 232
Recorder, 41, 42, 44, 52, 69
Reed, free, 55, 56
Instruments, 36-41
Reference books, 28, 57, 82, 107 134, 162, 194, 232
Reger, Max, 99
Review Questions, 27, 56, 81, 105, 133, 161, 193, 231
Reynolds, Sir Joshua, 228
Rheingold, Das, 188, 212
Ride of the Valkyries, 170, 212
Rienzi (Wagner), 55
Rimsky-Korsakoff, 144, 145, 169, 170, 179, 203, 205, 206
Rossini, Giacomo, 55, 148, 168, 210
Rote, 79
Rotta, 64
Rotte, 64
Ruckers, Andreas, 110, 114

SACHS, DR. CURT, 45
Sackbut, 52, 69, 190
St. Francis (Pierné), 224
St. Paul, oratorio of, 55
Saint-Saëns, Camille, 17, 138, 145, 151, 208
Salo, Gaspar da, 137
Salomé (Hadley), 177
Sam Yin, 73
Santire, 75, 77
Saron, 25
Scheherazade, 145
Schiller, Friedrich von, 228
Schillings, Max von, 184
Schroeter, Christoph G., 121
Schubert, Franz, 190-229
Schumann, Clara, 130
Schumann, Robert, 127, 128, 130, 153, 174, 221, 229
Scores, orchestral, 214-218
miniature, 232
Seasons, The, 183
Semiramide Overture, 148
Serinda, 79
Serpent, 54
Shakespeare, William 59, 164, 228

Shawm, 38-41, 49, 52, 69, 95, 172, 175
Shêng, 55
Shudi, Burkhard, 115
Siegfried, 145, 176, 190, 191
Sinfonia Sacra (Widor), 224
Sioux Indians, 20
Sleigh bell, 209
Sonata in A-minor (Mozart), 123
Sonatas of Beethoven, 123, 124, 125
Sonorous Vibrations, control of, 3, 4
Spencer, Herbert, 18, 218
Spinet, 77, 110, 111, 112, 113, 115, 119
Spontini, Gasparo, 213
Stabat Mater (Palestrina), 90
Stein, Johann Andreas, 122
Steinway & Sons, 132
Stodart, Robert, 122
Stopped tones, 184
Stradivarius, Antonio, 137
Strauss, Richard, 185, 222
Stringed instruments, table of, 60
String quartet, 159, 160
Stumpf, Prof. Carl, 16, 230
Suite Algérienne, 151
Suite L'Arlésienne, 219, 220
Sullivan, Sir Arthur, 210
Symphony
  Beethoven, No. 3, 221
  Beethoven, No. 5, 153, 218
  Beethoven, No. 7, 218
  Beethoven, No. 8, 218
  Beethoven, No. 9, 192, 219
  Brahms, No. 1, 177, 203, 221
  Dvořák, No. 5, 174
  Haydn Military, 214
  Mozart, 216, 217
  Saint-Saëns, No. 3, 224
  Tchaikovsky, No. 4, 145, 172, 176, 179, 188
  Tchaikovsky, No. 6, 144, 170, 176, 182, 202, 213, 222
Syrinx, 3, 30, 84

TABLE of Stringed Instruments, 60
  Wind instruments, 35
Tabor, 197
Tambourine, 15, 17, 18, 209, 211
Tam Tam, 18, 212
Tannhäuser, 173
Tannhäuser Overture, 140, 148, 181, 185, 191, 207
Tchaikovsky, P. I., 142, 144, 168, 170, 172, 176, 179, 182, 188, 190, 192, 202, 209, 211, 213, 216, 218, 219, 222, 224, 229
Temperament, equal, 118, 119
Theodosius, The Great, 85
Theorbo, bass, 69
Timpani, 191, 192, 203, 212
Tomahawk, 20
Tom Jones (Philidor), 183
Tone color in the orchestra, 165
Trainman's call, 20, 21
Transposition, 180, 181, 184
Triangle, 19, 203, 209, 213
Trio, Op. 101 (Brahms), 131
Triple wind, 43, 220
Tristan and Isolde, 38, 150, 152, 211, 218
Trombone, 41, 49, 52, 53, 54, 185, 187, 190, 220, 221

Trumpet, 7, 8, 32, 44, 45, 46, 48, 49, 50, 52, 53, 54, 69, 178, 182, 185, 186, 187, 188, 189, 190, 220, 221, 222
Slide, 53
Valve, 189, 202
Tuba, 41, 187, 188, 191, 222
Turkish crescent, 19

ULTIMATE Import of Musical Instruments, 4
Universe, unity of, 1
Urheen, 78

VALVE HORN, 189, 202, 222
Valve trumpet, 189, 202
VERDI, GIUSEPPE, 55, 71, 155
Villanelle du diable, 224
Viol, 6, 8, 41, 44, 47, 50, 78
Viola, 70, 136, 147, 149-151, 152, 156
Violin, 43, 68, 70, 136, 156, 165
bowing, 142
double stops, 140, 141
harmonics, 141
less known relatives of, 157
pizzicato, 144
positions, 139, 140
tremolo, 143
Violin family, 136-163
Violoncello, 41, 136, 147, 151-154, 156
Viols, chest of, 80
Virginal, 44, 77, 110, 112
Virginia Indians, 12
VOGLER, ABT, 97
VON BÜLOW, HANS, 149
Voo Kam, 78, 79

WAGNER, RICHARD, 4, 38, 43, 44, 55, 70, 108, 130, 140, 143, 146, 148, 150, 152, 153, 154, 170, 176, 179, 181, 182, 185, 188, 189, 190, 191, 200, 205, 206, 207, 208, 211, 212, 213, 215, 216, 218, 220, 221, 223, 224, 225, 229
Walküre, Die, 189, 223, 224
WASHINGTON, GEORGE, 229
Water Organ, 85, 86
WEBER, CARL MARIA VON, 122, 180, 191, 210
Whistle, 6, 33
Glissando, 209
Whistle-flute, 41, 166
WILHELMJ, AUGUST, 223, 224
William Tell Overture, 51, 168, 210
Winchester Organ, 87, 88, 89
Wind instruments, 30-56, 164, 182
classification of, 9, 35
Brass-wind, 164, 182
three-fold groups of, 43, 220
Wood-wind, 164, 182
WIDOR, CHARLES M., 224
Winnebago Indian Chant, 15
Wong Seo, 31
Wood-wind, 164, 166, 192

XYLOPHONE, 24, 203, 208, 209, 213, 214

YEE YIN, 78, 79
Yong Kim, 71, 76
Yu, 13

ZAMIR, 37, 38
Zimbalon, 75
Zincke, 53, 54, 186
ZUMPE, JOHANNES, 121

a39001 003054429b